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NOV '60

The Farmer's Digest

From more than two hundred magazines and bulletins published in this country and abroad, the Editorial Staff of the Farmer's Digest selects articles of outstanding merit and general interest. It is comprehensive in its scope, covering all phases of Agriculture.

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New Facts in Pasture Management

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GOOD pasture management means a system of fertilization and grazing which insures that an animal is able to consume during each day of the grazing season, the maximum amount of feed of a chemical composition suitable for the maintenance of health and condition, and for the production of milk, meat, bone, wool, or other product desired.

Investigations which have been in progress at Cornell University since 1931 have resulted in the establishment of a well-defined pasture program for the State of New York, which has already proved its effectiveness.

In Great Britain, a country famous for its pastures and for its livestock, pasture research has received considerable attention for many years. The earliest successful work was commenced by the late Sir William Somerville at the Cockle Park Experiment Station of the University of Durham. The experiments established in 1897 demonstrated conclusively the importance of phosphorus in pasture fertilization.

During the first 21 years of the experiment a plot treated with phosphorus in the form of basic slag applied in amounts equivalent to about 1500 pounds of 16 per cent superphosphate every six years, resulted in a live weight increase of sheep amounting to 2427 pounds per acre during the period, compared with 602 pounds on the untreated plot.

The late professor D. A. Gilchrist was the first to recognize the importance of wild white clover in pasture improvement. He was able to demonstrate that the white clover which occurred in old pastures and spread so rapidly when fertilized with phosphorus was different from the common white Dutch clover obtainable from seedsmen. Plants produced from white Dutch

clover seed lived one or two years only, whereas the plants produced from seed of wild white clover harvested from old pastures, behaved as a true perennial and persisted permanently if properly fertilized and grazed.

The experiments at Cornell University have shown that New York pastures are very similar in their response to fertilization and management to British pastures. Phosphorus is the first essential in their improvement and heavy applications result in the development of wild white clover just as in the case of British pastures. This wild white clover, like English wild white clover, is a true perennial and different from commercial white Dutch clover. This is to be expected, as historical records show that white clover is not a native of this country, but reached our shores in the hayloft seeds brought by early settlers. These hayloft seeds were obtained from hay harvested from old permanent meadows in England which contained much wild white clover.

The Cornell University experiments have shown that wild white clover is the key to pasture improvement in the northeastern states. This is due to its high productivity and high feeding value, and to its beneficial influence on the growth of grass. In 1935 a plot seeded in 1933 with 24 pounds of Kentucky bluegrass and 2 pounds of Kent wild white clover per acre, yielded 4985 pounds of dry matter per acre containing 31 per cent of protein, whereas a plot seeded with 24 pounds of Kentucky bluegrass per acre alone yielded 881 pounds of dry matter per acre containing 18 per cent of protein. The mixture as grown contained 55 per cent clover and 45 per cent grass. The clover separated from the grass contained 25 per cent protein. The higher content of protein in the grass when grown with wild white clover is partly due to the nitrogen provided by the clover through the bacteria which live in the roots, and partly because of the more favorable conditions provided for growth.

The experiments have shown that the soil temperature of a plot consisting of grass and wild white clover is maintained at a lower level during the hot summer months. There has been in recent years at Cornell University an average difference of about 8 degrees F. in the mean maximum soil temperature at one inch below the surface. More important than this, however, is the effect of the wild white clover sward on the temperature range. During the peak period of growth on May 22, 1936, the soil temperature at one inch in a plot of Kentucky bluegrass alone ranged between 40

degrees and 73 degrees, whereas the plot of Kentucky bluegrass and wild white clover ranged between 47 degrees and 68 degrees. The effect of the wild white clover has been to maintain the soil temperature within a range which permits of more rapid growth. Most of the pasture plants of the northeastern states appear to commence growth at a surface soil temperature of about 40 degrees; grow most rapidly between 60 and 65 degrees; and cease growth at a temperature between 70 and 75 degrees. The low productivity of pastures during July is closely correlated with high soil temperatures and when these high temperatures are accompanied by drought, as is frequently the case, pastures cease growth completely.

Wild white clover has been found to better the supply of moisture in the soil. On a thin open swarded pasture on a slope, much of the rainfall during the summer months, which occurs as heavy thunderstorms, is lost by runoff from the surface. Experiments have indicated that from 10 to 40 per cent of the rainfall may be lost in this way at the time when it is most needed. A close sward of grass and wild white clover provides almost perfect protection against soil erosion and the loss of water by runoff, the amount lost varying from less than 1 per cent up to about 5 per cent.

This is partly due to the protection of the soil by the herbage which prevents the direct impact of raindrops with the soil and partly to the resistance to passage of water over the surface provided by the leaves and stems. Another factor is the more porous condition of the soil resulting from the development of roots under the favorable conditions provided. This again results in an increased content of earthworms in the soil. In the fall of 1936 a plot which had been treated with superphosphate and lime and had developed an excellent sward of grass and wild white clover, was found to contain 116 pounds of earthworms per acre compared with 30 pounds per acre on the adjoining untreated plot which consisted largely of devil's paintbrush. The activities of the earthworms aid in the rapid absorption of water by the soil.

The effectiveness of wild white clover in collecting nitrogen is indicated by the fact that in 1935 a plot of the Cornell Pasture Mixture yielded 6276 pounds of dry matter per acre containing 31 per cent of protein. The amount of nitrogen removed in the herbage was equivalent to 1511 pounds of sulphate of ammonia per acre. When such a large amount of nitrogen is re-

moved in the herbage from a good pasture, there is little reason to expect a marked increase in yield from the application of 100 pounds of sulphate of ammonia per acre. Actually in the Cornell University experiments with wild white clover pastures, applications of 218 pounds of sulphate of ammonia have either resulted in a negligible increase or a small decrease in yield and in protein content. This is due to the harmful effect of inorganic nitrogenous fertilizers, particularly those which provide ammonia, upon wild white clover. In this experiment the untreated plot contained on the average 51 per cent of clover, a plot which received 200 pounds cyanamid contained 41 per cent, one which received 218 pounds sulphate of ammonia contained 42 per cent, and one which received 288 pounds of nitrate of soda contained 45 per cent.

The presence of wild white clover influences the palatability of the herbage as a whole and results in closer and more uniform grazing. The high lime content of wild white clover changes the mineral balance of the herbage and brings the ratio of phosphoric acid to lime closely into line with that of milk.

Because of its influence on soil temperature and soil moisture, and because it is able to grow at fairly high temperatures, the presence of wild white clover in a pasture results in more uniform production throughout the grazing season.

Successful pasture improvement and management in New York depends upon methods of fertilization and grazing management which are beneficial to wild white clover. First in importance is the application of phosphorus. In New York the application of 800 pounds of 16 per cent superphosphate or its equivalent at intervals of three or four years is recommended on all soil types. Soils which require lime for the satisfactory growth of red clover are benefited by an application of lime in addition to phosphorus. This is particularly important on soils testing below pH 5.5. Usually an application of 2000 pounds of ground limestone per acre is sufficient at intervals of about 6 years.

Light sandy and gravelly soils, and occasionally other soil types, may require potash also. This may be applied as muriate of potash at the rate of 100 to 150 pounds per acre at intervals of 3 or 4 years.

Pastures which previous to treatment contain very little, if any, wild white clover, should have about one pound of wild white clover per acre seeded on the surface in late March or early April. Some pastures which

are too poor to justify improvement without breaking up are best plowed or harrowed, fertilized as suggested and seeded with the Cornell Pasture Mixture in April, without a nurse crop. The field may be lightly grazed in the year of seeding.

Equally as important as the methods of fertilization are the methods of grazing management. An average cow in a good pasture can consume about 150 pounds of green herbage, containing about 30 pounds of dry matter, in a day. Actually only about 8 hours are spent in grazing, the remainder of the time being occupied in chewing the cud and resting. A heap of green grass weighing 150 pounds is about 6 feet in diameter and 3 feet high in the center. The fact that a cow must consume this with the aid of a three-inch lawn mower during a working day of 8 hours, is an indication of the task involved. On poor pastures the task is impossible and it is not made much easier by allowing access to an increased acreage.

The way to learn the principles of grazing management is to spend several hours in a good pasture closely observing the nose end of a good cow. She will be found to select short leafy herbage in preference to tall stemmy herbage, and, if she has plenty of such material to graze, she will graze steadily without raising her head for periods of half an hour or more while walking slowly forward and moving her head from side to side. Luxuriant herbage growing where droppings have fallen previously, is avoided. This appears to be due to the odor, because the same herbage hand picked and held out to a cow or placed on the ground a short distance away from the place where it grew is usually eaten readily.

The maximum amount of herbage is consumed at a bite when the sward is very dense and about 4 inches in height. Under such conditions a cow will graze closely to within half an inch of the soil surface. Taller herbage, if consumed at all, may be eaten from the top in which case only about 4 inches can be taken at a time, or it may be gathered sideways with the aid of the tongue. In this case the herbage is too long to swallow and the head must be raised, while time is taken to get the grass into a condition for swallowing. Because of the greater difficulty of grazing and because of the lower feeding value and digestibility of tall grass, the amount of food gathered in a day is less on a pasture consisting of tall stemmy grass than it is on a well managed pasture containing a dense sward of herbage averaging about 4 inches in height. Furthermore,

wild white clover is intolerant of shade and is soon killed out if the herbage is allowed to grow tall. The absence of the clover results in a deficiency of nitrogen and decreased production of herbage.

Good grazing management involves close grazing early in the season as soon as the grass has reached about 3 inches in height. In New York State this is usually during the first week in May. In practice the stock are turned out to pasture as soon after the first of May as the ground is dry enough to carry them without undue injury to the turf. At Cornell University it is our practice to use four fields which are grazed in rotation. The stock occupy each field for a period of 5 to 7 days during the early part of May and for longer periods later. Each plot is grazed as closely as possible before the stock are moved to another plot. On some farms milk cows occupy each field first and are followed by dry cows and young stock to complete the grazing. Having been closely grazed the field is then allowed a rest of 2 to 4 weeks before it is grazed again. Under favorable conditions this permits the herbage to reach a height of about 4 inches. Pastures grow most rapidly in late May during what is known as the peak period of growth. At this time it is difficult to prevent some of the herbage in some of the fields from reaching the heading-out stage. Immediately as this happens the field is cut as closely as possible with a mowing machine two or three days before the stock are removed to another field. The herbage cut is then eaten by the stock and fresh growth is permitted to take place ready for grazing later in the season. Sometimes more than one mowing is necessary in the season. On badly managed pastures cattle often will be found to obtain their feed from less than one-half the area available as they graze parts of the field closely early in the season and return to those areas while the tall herbage remains ungrazed.

Once during the year, particularly in September, but more frequently if circumstances permit, the cattle droppings are scattered by means of a flexible grass harrow. This prevents the formation of ungrazed tufts later and makes the manure beneficial instead of harmful.

Early in the season, before stock are turned out to pasture, each pasture is rolled with a smooth roller to reduce injury caused by winter heaving and to facilitate even grazing and close mowing later. Stock should not be permitted to remain on pasture too late in the fall. It is desirable to remove them suffi-

ciently early in October to permit a growth of about 3 inches to be made before winter arrives. During this period food reserves are stored up which reduce injury by winter heaving and result in earlier growth and greater productivity the following spring.

New pastures established with the Cornell Pasture Mixture produce more uniform growth throughout the grazing season than do old pastures, but even these do not produce as much in July as they do in May. This difficulty can be overcome effectively by increasing the pasture area in July with the aid of long term or permanent meadows. These fields are seeded with a special type of mixture known as the Cornell Hay-Pasture Mixture. They may be grazed for a short time in late April or early May and then put up for an early hay crop in June. After this crop has been removed the aftermath is used for pasture. The hay produced is of good quality and contains a considerable amount of wild white clover. If fertilized every three years with manure and superphosphate, they may be maintained in excellent condition for long periods or even permanently as is the case in England.

Other supplementary pasture crops are alfalfa and Sudan grass both of which are of special value at the time when increased pasture is most frequently needed. Hay cut from the permanent meadows may be used also in dry seasons.

Because of the high protein content of well grazed improved pasture herbage, supplementary feed high in protein is unnecessary for milch cows or other stock. High yielding cows giving more than 30 to 40 pounds of milk a day are unable to obtain sufficient feed even from excellent pasture to maintain themselves in condition while producing this quantity of milk and they should receive concentrates at the rate of about 3½ pounds for every 10 pounds of milk produced above 30 pounds. Such concentrates need not contain more than 12 per cent protein. As the season advances and the condition of the pasture is less satisfactory the allowance of concentrates may be made to cows giving more than 10 or 20 pounds of milk and on poorer pastures the protein content may be raised to 16 per cent or higher.

Stock grazing poor unimproved pastures which are likely to produce herbage low in phosphorus and lime should be allowed access to a mineral mixture consisting of bone meal, limestone and salt.

The essentials of the New York Pasture Program for 1937 are as follows:

1. Improve the best pasture land on the farm.

2. Improve one acre of pasture for each cow or its equivalent to be maintained on the farm.

3. The annual cost of a sound pasture improvement program need not exceed $2 a year for each acre improved or for each cow or its equivalent maintained on the farm.

4. Apply to all pastures to be improved, preferably in the fall, 800 pounds of 16 per cent superphosphate or its equivalent per acre and repeat at intervals of about 4 years.

5. An application of lime sufficient to permit the growth of red clover is desirable, especially when the limestone requirement for red clover is greater than 2000 pounds per acre or when the pH is less than 5.5.

6. Light sandy and gravelly soils may require an application of about 100 pounds of muriate of potash per acre at intervals of about 4 years. Heavier soils seldom respond to potash.

7. Nitrogen is as important as phosphorus in pasture improvement. The nitrogen required is best obtained through pasture legumes, especially wild white clover. Pastures containing an average of less than one plant of wild white clover to the square yard, evenly distributed, should be seeded with 1 pound of wild white clover to the acre in early April, or they may be plowed, fertilized and seeded with the Cornell Pasture Mixture.

8. Grazing Management is as important as fertilization in pasture improvement. The following rules should be observed:

(a) Stock pastures sufficiently heavy to prevent herbage from exceeding an average of 4 inches in height at any time.

(b) Stock pastures when a growth of about 3 inches has been made and when the ground is dry enough to carry stock without excessive injury to the turf.

(c) Remove stock from closely grazed pastures sufficiently early to permit a growth of about 3 inches to be made before winter arrives.

(d) As an aid to good grazing management, divide the pasture area into about 4 fields each with independent access to water and graze these in sequence.

(e) Mow pastures very closely once or more during the grazing season, particularly at the end of the peak period of growth in June.

(f) Heavily stocked pastures should have cattle droppings scattered once or more during the grazing season, particularly in September.

(g) Roll pastures with a smooth roller in April or early May to reduce damage done by

winter heaving and to facilitate close mowing and even grazing.

9. Open up existing water courses and drain excessively wet spots in pastures.

10. Establishing new pastures.

(a) Prepare seed bed by plowing or harrowing.

(b) Fertilize as for old pastures.

(c) Seed in April or May, preferably without a nurse crop.

(d) Control weeds by mowing until July, then graze until September in year of seeding, if sufficient growth has been made.

(e) Use the following mixture:

Cornell Pasture Mixture for 1937

Kentucky bluegrass	10 pounds
Canada bluegrass	2 pounds
Rough stalked meadow grass	1 pound
Timothy (preferably Aberystwyth pasture timothy No. S.50)	6 pounds
Perennial ryegrass (preferably Svalof Victoria)	5 pounds
Wild white clover (preferably Kent old pasture)	1 pound
	25 pounds per acre

History of the Silo

Condensed from Hoard's Dairyman

THE word silo is derived from the latin "sirus" or "silus" meaning cellar. The first silos were mere holes in the ground lined with straw or stone and filled with cut fodder.

If we delve into history we find that silos and silage are of ancient origin. Egyptians put their grains and other crops in jars and sealed tightly. The Mound Builders of North America, and the Incas of Peru understood the principles of ensiling crops. Caesar built clay-lined pits along the roads, filled them with green fodder, sealed them with clay, and used these "silos" to feed his horses in times of necessity. The Teutons used pits to make sauerkraut.

Beginning about 1860, several Europeans were experimenting with silage, especially in the use of corn for this purpose. In England there was Samuel Jonas. Germany had its Adolph Reihlan. In France, August Goffart won prominence, and his work was recognized in 1876 when he was awarded a decoration of honor for the preservation of maize. All these men had long pits for silos.

America's earliest reference to the silo seems to be that built by Fred Hatch, McHenry County, Illinois. While claims are made

Reprinted by permission from Hoard's Dairyman, Fort Atkinson, Wisconsin

that this silo was used in 1873, there is some doubt as to the accuracy of that date. Manley Miles, Michigan farmer, had a silo in 1875. Levi P. Gilbert, Jefferson County, Wisconsin, read the teachings of the Frenchman Goffart, dug and filled with corn a pit silo 6 feet wide, 6 feet deep, and 30 feet long. The corn stalks were put in whole and the silo was sealed with straw. This was in 1877. In Maryland, Francis Morris constructed and used a silo to feed his herd of cattle in the year 1876. O. B. Potter, New York. made ensilage in 1877.

C. W. Mills, a New York grain merchant, seeking to improve the quality and size of the corn grown on his Arrareek Farm, Passaic County, New Jersey, planted tall growing southern corn side by side with his own corn hoping they would cross. Imagine his dismay when, in late September of 1876, he found his native corn ripe and the southern corn immature. He hated to be laughed at by his farmer friends. Remembering the old method of keeping roots in mounds, he ordered all hands to dig pits and fill them with the corn.

Many dignitaries were present for the opening of the Bailey silo, at Bellarica, Massachusetts, on December 3, 1879. Among those in attendance were the editors of several New York city newspapers, and the U. S. Commissioner of Agriculture. The Bailey silo was partly above ground.

At the University of Tennessee, J. M. McBryde began experimenting with silage in 1879. Two years later the stations at Wisconsin under Dean W. A. Henry and at Cornell under I. P. Roberts, did pioneer work in ensiling corn.

The year 1880 saw two Wisconsin farmers try this new fangled process. Plodding along with a few cows on his 48-acre farm near Oconomowoc, L. W. Weeks was losing money. Before giving up his farm he decided to give the silo a trial. It was built in the side of a hill and adjoining the barn. He put up 100 tons of corn silage. So successful was this enterprise that Mr. Weeks was enabled to increase the size of his dairy herd.

Among the visitors to the Weeks' silo were two men who were active in the promotion of the silo. One of these was Dean Henry. The other was a neighbor farmer, John Steele, who was also building one of these contraptions. The John Steele silo used half of a root cellar already in existence. Mr. Steele was a member of the state assembly. In 1881, when Dean Henry asked for $4,000 with which to conduct silage investigations, Mr. Steele was the only one who could speak from experience and his

efforts were a great help in securing the appropriation.

It is reported that John Steele was among the first to build a round silo above ground. An old maple sap tub on his place furnished the idea. The silo was 18 feet in diameter and 30 feet high, made of 2 by 5-inch staves.

E. J. Oatman, Dundee, Illinois, had a fine silo demonstration on his farm in 1880. The pit was 49 feet long, 43 feet wide, and 20 feet in height. It was divided into three compartments and plastered with cement. That fall was a wet one. His neighbors may have laughed when he filled his silo, but they certainly had cause to be jealous when there was a good supply of cow feed on the Oatman farm that winter and a scarcity of cow feed on their own farms.

The early above-ground silos were square in shape. Much spoilage occurred in the corners. F. H. King, agricultural engineer at the Wisconsin College of Agriculture, made an exhaustive study of the situation, traveling through several midwest states to gather facts and information. He built a round silo in his own barn at Madison. The popularity of round silos today is due largely to the pioneer efforts of Professor King. Another "silo missionary" was John Gould, a stockman at Western Reserve, Ohio, who spoke at many farmers' institutes in Wisconsin and elsewhere giving his own experiences with silage.

In 1882, it was estimated that there were 91 farmers owning silos in the United States. While no official count or census of silos has been taken recently, it is estimated that the silo population is well over the half million mark today. Wisconsin leads the nation with better than 121,000 silos. New York is in second position. Not until the 1890's was there any great increase in silo construction. The work of agritural colleges and other pioneers established, without the shadow of a doubt, the great value of the silo in stock feeding. Two other factors were responsible for the boom in silo building. One of these was the drought which kept the corn from maturing. Ensiling provided an opportunity to turn what would otherwise have been a feed shortage into a sufficient feed supply. The other factor was the coming of commercial manufacturers to sell silos and silage machinery to the farmers.

Silos in use today are of two types — the above ground round silo, and the trench silo which is an adaptation of the old pit silo. The round silo is the common type, but there are instances where the trench silo is very useful because of its simple construction and cheap cost.

Marketing Roughages Via Steers

Condensed from The Hereford Journal

John H. Jones

Animal Husbandman, Texas Agricultural Experiment Station

THE "Blacklands of Texas" produce an enormous amount of roughage. These lands may be expected to produce increased amounts of such crops as are being used in the control of cotton root rot and soil erosion. With any increase of roughage and grain crops, means of marketing them become increasingly important. The cash grain market will supply an outlet for any surplus of grains, but roughages, with the exception of alfalfa hay, have limited market outlet and are mostly unused except in locality where grown.

Breeding herds of beef cattle have been in the area for years, being on the rough broken lands, in Johnson grass bottoms, and, in some instances, on abandoned fields. Most of the increase from such herds has been marketed only as grass cattle. There has been little feeding for fattening. Just why this has been true is not apparent, but there is an opportunity for increased cattle feeding in the "blacklands."

There are two or three methods which appear workable for the situation of a sufficient acreage of pasture land to maintain a herd of beef cows and some grain production: The cow herd can utilize the roughage and the calves can utilize the grain through creep feeding and through additional grain feeding in drylot after weaning time. It must be understood that calf feeding for fattening requires grain feeding. Calves utilize grain more efficiently than cattle of any other age. A little grain combined with grass and milk will produce large gains and permit the marketing of heavy slaughter calves at weaning time.

If there is additional grain for the calves, they may be fed in drylot after weaning in which case they get on full feed quickly and can be made into desirable baby beeves in about 120 days. If a calf which has just been weaned and has not been creep-fed is put into drylot on fattening ration, six months is required to make a desirable baby beef. This type of feeding, that is, trying to produce baby beef by drylot feeding of weaned

Reprinted by permission from The Hereford Journal

calves, has resulted in plenty of failures, and has left a good many beginning feeders discouraged. Let us creep feed calves for five to six months before we go into drylot on a grain fattening ration, or if we buy weaned steer calves, let us make them into yearlings on the farm before we try to finish them by drylot feeding.

This is the method Substation No. 1 of the Texas Experiment Station, Beeville, Tex., has been following. Weaned steer calves are bought in the fall to clean up the fields. They are wintered on silage stored in a trench silo, a little grain and cottonseed meal. They are placed on Sudan grazing about April 10 since no native pasturage is available and remain on Sudan as long as it lasts. They are then placed in drylot for a finishing feed on ground ear corn, cottonseed meal and silage.

One such group of steer calves handled in this manner started on wintering ration December, 1934. These calves gained 144 pounds per head in the 125-day wintering period, 231 pounds per head in the following 175-day Sudan grazing period, and 290 pounds in the 127-day drylot finishing period, a total of 665 pounds per head in the 427 days they were kept on the Station farm. They were fed, in addition to the silage and grazing, 650 pounds of cottonseed meal and nearly one ton of ground ear corn per head. They were well finished yearling steers when marketed in February, 1936.

In case the farm has a crop of roughage to market and has not carried or does not have the facilities to carry weaned calves until they are yearlings for finishing, the methods employed by the Substations at Spur and Balmorhea should be of interest.

The Spur Station either buys or develops through grazing steer yearlings to go on feed in the fall and feeds grain sorghum and red top silage stored in a trench silo, and cottonseed meal. No grain is fed except that contained in the grain sorghum silage.

A group of yearling steers, average initial weight 676 pounds, were started on silage and cottonseed meal in November, 1935 following a 30-day ration of cottonseed meal and cottonseed hulls.

They were fed 5.2 pounds of cottonseed meal, 37 pounds of silage, and 2 pounds of dry roughage per head daily for 175 days and were highly finished market topping steers when marketed May 12, 1936.

It required approximately 920 pounds cottonseed meal, 400 pounds dry roughage, and 3.5 tons of silage per steer.

The Substation at Balmorhea,

a small irrigated farm which has no pasturage, makes extensive use of hegari as a steer fattening feed. A group of steers marketed July 1 of this year at an average price of nearly 12 cents per pound on the Fort Worth market offers a good example of what can be done with rations high in roughage. These steers were fed for 196 days on an average daily ration of 1.5 pounds cottonseed meal, 2 pounds cottonseed, 2.44 pounds ground milo heads, 4 pounds alfalfa, and 14.36 pounds ground hegari bundles. The steer yearlings, average weight when started on feed, 720 pounds, were fleshy grass yearlings of very high quality. They did not make particularly high gain but did make high finish. This feeding was a demonstration of a method in using large amount of roughage feeds in fattening. The 60 steers so fed consumed approximately 83 tons of ground hegari bundles, 23 tons of alfalfa, 8.5 tons cottonseed meal, 11.5 tons cottonseed, and 14 tons milo heads.

It will be noted that, in producing finished steer beef on the farm with an extensive use of roughage feeds, each Substation —Beeville, Balmorhea, and Spur—marketed yearling steers. The Balmorhea and Spur Stations bought yearlings and started them in drylot to market an accumulated crop of roughage; the Beeville Station bought weaned steer calves and grew them into yearlings on the farm before starting them in drylot on a finishing ration.

Certain generalities may be summarized: A feeder cannot expect to make weaned calves into highly finished baby beeves without feeding a ration high in grain for six to seven months. The man who produces his own calves can creep-feed for five to six months and can either sell the creep-fed calves as fleshy calves or feed them an additional three to four months in drylot on a grain ration after weaning and make them into fattened baby beeves. The feeder can expect in starting with fleshy yearling steers to make them highly finished by an extensive use of roughage feeds in six to seven months but must use a balanced ration.

Lights Increase Profits

Condensed from American Poultry Journal

Ralston R. Hannas

THE use of lights on the laying flock is a well established form of poultry management. Commercial poultrymen and flock owners have used them for years to increase the profits in their flocks.

Although it was formerly felt that the value of lights to increase production in the season when production was normally low, was due to the increased time allowed the birds to eat more feed, it has within recent years been found that the benefits obtained by the use of lights were due to the stimulation of the ovaries by the light itself. Since there is a stimulating effect of light on the ovaries, poultrymen will do well to use it to best advantage.

Knowing the amount of natural light that is available at various times of the year will enable a poultryman to give his birds additional light at the proper time in order to increase production and at the same time keep his birds in the best of condition. The New Jersey Agricultural Experiment Station has printed a table showing the total hours of possible sunlight for the State of New Jersey at semi-monthly intervals throughout the year. These amounts of sunlight, which may vary slightly in different latitudes, are given in the following table:

January	9.7	July	14.7
February	10.7	August	13.8
March	11.9	September	12.5
April	13.3	October	11.2
May	14.4	November	10.0
June	15.0	December	9.3

The best egg production, without the use of artificial lights, is obtained during May and June when there is the greatest amount of normal daylight; the lowest egg production, without the use of lights, occurs during the short days of late fall and early winter, when the amount of normal daylight is the lowest. Although it is true that such factors as temperature, molt, and the age of the bird, affect fall and winter egg production, experienced poultrymen know that light has a direct beneficial effect in increasing egg production.

Since the value of artificial

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light lies in increasing the egg yield at the season of the year when egg production is normally the lowest, and, therefore, the prices received for the eggs are normally the highest, the profit from the use of lights on a flock of layers will be increased by an intelligent use of lights in fall and winter.

For example, recent figures obtained in an experiment at the South Carolina Experiment Station showed that egg production was increased enough with the use of lights to make an added profit of $24.03 on a flock of 126 White Leghorns during the months of October through February.

In most instances, best results by the use of lights will be obtained when birds are allowed to come into production normally. Pullets that have been properly cared for during the brooding and growing period should start to lay when they are 5 to 7 months of age, depending upon breed, variety, and strain. In most cases, these birds should be laying better than 50% by the time they are 7 months of age. It is a good plan, therefore, to start the use of lights on pullets that have reached the age of about 7 months, that is, pullets that have been hatched at the normal hatching season—April or early May.

By starting at this time, it should be possible for a poultryman or flock owner to bring production up to 50% if it has not been this high previously, and to maintain it if it has already been at this level. When there is a tendency for production to drop below 50% as measured over a period of one week, additional light may be used to keep it at this level. At the New Jersey Station, for example, this method was followed and a satisfactory egg yield maintained during late fall and early winter on January and February hatched pullets, when birds not receiving artificial light went through almost a complete molt. According to this Station, "The light was increased one hour every time the production fell below 50% for a 7 day period. Actually, the light had to be increased about one hour every third week after September 1st, and eventually the birds were receiving artificial light from 2 A.M. until daylight."

Not only can lights be used to advantage on pullets that are hatched in the normal laying season, but they can be used advantageously, as just indicated by the New Jersey results, on early hatched pullets to prevent, or at least minimize, the molt that normally occurs in the fall on such stock. Beneficial results are also obtained by the use of lights as used in the barracks system that is followed to some extent in

New England. This involves the use of lights beginning about August 15th on birds that are finishing their pullet year production. Such birds are culled about the first of August, and the poorest disposed of immediately. Those that are to be held over as breeders are kept in a flock by themselves, while the intermediate ones are put under lights and all eggs possible obtained from them until they go into the molt the last of December or the fore part of January, at which time they are disposed of.

One of the important advantages of lights is to counteract effect of "bossism" in a flock of pullets. This is accomplished by lengthening the day so the less aggressive ones, that are bossed away from the feed hoppers by the others that dominate during the day, will have an opportunity to eat that they otherwise would not have.

Some poultrymen use lights to advantage on birds to be used as breeders later on that are finishing their pullet year, from about the middle of August until about the first or middle of October, but they make sure to discontinue them at this time so that birds may have a complete rest, molt normally and evenly, and be in condition to produce eggs for hatching purposes in the normal breeding season. Lights may be used on breeders that have gone through a molt in order to hasten them into the production of hatching eggs. When used on such birds, they may be started about the last week of December or the first week of January. There is no harm, when using lights on breeders in this manner, if they are used from about 5 A.M. until dawn during January, February and March.

The question of forced molting of hens has come to the fore in recent years, and where this system of management is used, lights have their place in order to bring these birds back into laying as quickly as possible. Where hens are forced molted, lights are used about the 7th week after molting is started and are used from then on until the end of profitable production. Sufficient light is used to give the birds a 14-hour day.

Lights also have a beneficial effect in the case of immature, inferior pullets, by bringing them into production more quickly than would otherwise be the case. They are of particular help in this connection with late hatched birds. If such birds are allowed to come into production normally, they are apt to be a long time doing so and will likely be unprofitable for their owner. Not only is this the case, but they are apt to be a menace to the

rest of the flock because of the possibility of disease infection. One of the big advantages of the use of lights that is often overlooked is the fact that layers under lights, if properly handled, are usually in better health and in better condition than pullets not under lights.

There are several systems of using lights on layers. Under the morning light system, lights are used from very early morning until daylight, the time at which they are turned on depending upon the amount of total light that the flock owner wishes to give his birds. Usually they are turned on about 3 or 4 o'clock.

The evening light system consists of turning lights on at about dusk and burning them until whatever hour in the evening the owner wishes. This may mean turning them on about 3.30, 4 or 5 o'clock depending upon the length of the day, and burning them long enough so that the length of time they are on with the natural daylight will give 13 to 14 hours a day as desired. When this system is used, many poultrymen use dimmers so the lights will dim gradually when it is time to go off rather than to go off all at once. This is so the birds will not become stranded on the floor in the dark when lights are turned off.

Under the evening lunch system, lights are turned on for one hour any time during the evening after the birds have gone to roost, as for example, from 9 to 10. It must, however, be at the same time each night. Some poultrymen use dimmers for this system also in turning off the lights; others do not.

A combination of morning and evening lights is sometimes used whereby the amount of artificial light that is given is divided equally in the early morning until daylight and from dusk until some time during the evening. This system is especially useful in overcoming winter days that are unduly shortened by storms, fogs, and clouds.

The all-night light system consists of giving dim lights all night long. A 15-watt light is usually placed directly over the feed hopper.

No matter what system is used, all lights should be discontinued by April first.

The kind of light to use makes little difference: any convenient light source will serve. Electricity is ideal from the standpoint of efficiency, low fire hazards, and opportunity for automatic switches, dimmers, and water heaters. However, gasoline or kerosene lanterns may be used with good results.

In installing lights, lamps should be hung 6 ft. high and not over 10 ft. apart, equipped with conical reflectors 16 inches

in diameter, 4 inches high. These may be made of 28 gauge galvanized iron, painted with aluminum bronze. The perches should be lighted. One watt to each 4 to 5 sq. ft. floor area provides proper intensity. White washed walls and ceilings increase the effective use of the light. If grain is hopper fed, 25 watt lamps directly over feed and water may replace 40 watt lamps.

When hens are kept in batteries, light should be so placed that there will be the least amount of shadow and the most amount of light possible for all birds.

Automatic time switches make it possible for the lights to be turned on any time in the early morning or evening that the owner desires so it is not necessary for him to get up in the small hours of the morning. Such equipment is not expensive.

When lights are used, additional feed must be given. The laying mash, of course, is kept before the birds all the time in hoppers, but additional grain is fed. If it is hand fed in the litter, an additional 2 to 3 lbs. per 100 birds per day is given; if the grain is hopper fed, the hoppers should not be allowed to become empty, especially in view of the fact that pullets, although sexually mature, should increase their body weights up to February or March 1, reaching maximum egg size at the same time they reach maximum body weight.

It is good practice in feeding pullets under artificial light to encourage a grain consumption slightly in excess of mash consumption in order to maintain body weight. With breeding hens, however, it is well to encourage a consumption of more mash than grain or to use a moist mash containing alfalfa leaf meal and some dried milk product in order to insure proper intake of vitamin G that is essential for the hatchability of eggs.

One of the important points in the use of lights in the laying flock is to see that the same system of using lights is followed once it is started and no change made to a different system. Furthermore, there should be no interruption in the service, as irregular lighting will cause molting and production slump. This makes it advisable to examine the equipment at least once a week and see that it works satisfactorily and to replace any burned out lamps. This is especially desirable where automatic equipment is used.

If the farm is on an outlying rural service line, one or more reserve oil or gasoline lanterns are good insurance against current interruptions from sleet storms and other emergencies. Advise service company that emergency service is essential

and expected when necessary. Home lighting units, also, will furnish electricity for farm and poultry use and will avoid service difficulties that frequently arise in rural sections.

It is also well to see that lamps and reflectors are kept free from dust.

It is especially necessary when lights are used to see that there is plenty of drinking water available at all times, especially when the birds first come down from the roosts after the lights go on. Extra water is as essential as extra feed.

The Show Standards of Cattle

Condensed from **The Ayrshire Digest**

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WITHIN recent years, there has been a good deal of discussion concerning the conformation of the dairy cow and its relation to milk production. There has been much dispute concerning the value of show type for commercial purposes. The showyard is being criticized. This has now led to questions concerning the value of our pedigree breeds of dairy cattle and it is stated that the methods employed by stockbreeders in the past have been fundamentally unsound and that we are at the present day following the will-o-the-wisp policy of live stock improvement. The culminating criticism is that, in view of either modern requirements or scientific advances, or both, we should scrap our present methods and breeds and start afresh our whole work of dairy cattle improvement.

To the majority of those who are connected with the dairy cattle industry, the final conclusions of these critics, as recently voiced, appear absurd. The present era, however, is one of new methods and viewpoints. However outrageous such criticism may appear, it behooves us to examine it from a double standpoint. Is it sound economically? Is it based on scientific fact?

Let us first deal with the scientific aspect. Much has been written concerning the inheritance of milk yield. Unfortunately

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the greater part of this work is based upon mere observation, as distinct from ascertained fact. The scientific investigations on this subject are not numerous, but they are as many as could be expected, considering the rate of reproduction in the cow.

From the evidence available the following facts are clear:

Total yield of milk is largely conditioned by heredity.

Nutrition and environmental factors are important and cannot be neglected.

Total yield of milk is inherited in no simple manner.

Quality of the milk is largely inherited, and is to a much lesser extent affected by nutrition and environmental factors.

The amount of fat secreted by a cow is to a very large extent, inherited independently of the total yield of milk. As regards the other constituents, casein, sugar, hardness of curd, size and shape of the fat globule, and each of the principal minerals (except iodine), there is reason to believe that the same holds good.

All these points are reasonably well proved, and, while nothing is ever certain, they can be taken as the basis for future work. If the scientific method is worth anything, these facts must be used as the stepping-off place both for the further scientific work and for practical stock improvement.

The inheritance of milk yield has long been recognized by practical stockbreeders to be a problem of great complexity, and it is therefore but natural that the breeder should look to the geneticist for some method whereby the workings of heredity might be accelerated—the more so as the life of the dairy cow is short when compared with the time taken to prove her milking capacity. The average life of a dairy cow is about six years. She is three years old before any general assessment can be made of her productive qualities, and is four years of age before this figure can be obtained with any degree of accuracy. Accordingly, the breeder has evolved a lore concerning the relation of the form of the dairy cow to her productive capacity, a lore that also is applied to the dairy bull. It is this lore that has become the foundation of our showyard system and that is now being so violently attacked.

As far as science is concerned this lore falls into two parts. The first relates to the points that are capable of scientific measurement, and the second to those that have so far defied accurate measurement. Of the measurable points of the dairy cow, certain definite correlations have been found between form and function. With a few exceptions the relationship is so small as to be

barely worth further consideration from the practical aspect of stock improvement. Other things being equal, size, as measured by weight, bears a direct correlation to total yield. Thus it is that the progeny of certain bulls show an increased yield principally owing to the fact that their sire transmitted a big body rather than a big yield. Obviously, an Ayrshire cow will give more milk than the larger matron of the Scotch type of Shorthorn. Size is only an accessory factor towards increased production. To a lesser degree, certain measurements such as length, girth, etc., bear a similar relation to total yield of milk.

There is definite scientific evidence that conformation on the whole is no sound criterion of the true milking capacity of a cow. Especially as regards the shape of a heifer there is nothing measurable that can yet be considered to be of the slightest value as an indication of the amount of milk she will give when she calves. Indeed, scientific evidence points to the fact that it is definitely unsound to attempt to prognosticate the yield of a heifer either by measurement or by eye.

The other aspects of form—those that are not amenable to measurement—are probably of some importance, since they relate principally to the organs of milk secretion. One of these that has been scientifically examined, namely, the diameter of the milk wells, shows a definite correlation to productivity. It is, therefore, reasonable to assume that breeders, both past and present, are justified in taking into account the mammary development.

As the outcome of scientific observation it may be accepted that it is unwise to use conformation as a guide for the selection of cows with a high capacity for milk production, but this does not imply that conformation is without value. Unless a cow is capable of producing a minimum quantity of milk she is not a dairy cow no matter that she may belong to a dairy breed. Even if she does produce an adequate quantity of milk, she may still be unsuitable for commercial milk production. An adequate yield of milk as regards both quantity and quality is a prerequisite, but there are other points of equal importance.

Among these points are characters that affect the length of life of the cow, and others that affect her economic utilization of food or her powers to breed at regular intervals. If any of these characters can be shown to have any relation to conformation, then the principle of the method on which selection is at present based can be justified.

Take longevity first; it is the cow that produces 100,000 pounds in her lifetime that is more remunerative to her breeder than the cow that can produce 20,000 pounds in one lactation but cannot keep it up. We must recognize that in breeding for high production, we are selecting for a type of mammary apparatus that puts a severe strain upon the other organs of the body. It is as though in the thoroughbred horse we were to select for ability to move at great speed but, at the same time, were to neglect the development of the heart. It is the thoroughbred that can win races throughout a long life that is remunerative to its owner.

The qualities that make for longevity are various. Among the most important are the legs and feet. Crooked hind legs, poor pasterns, and soft hoofs are causes of serious loss in dairy herds and are definitely of genetic origin. If a cow has the right hind feet and legs, she can stand on concrete for fifteen or twenty years and she can travel to pasture without pain or trouble. It is very easy to get poor legs into a herd and the only way to prevent this defect is to select breeding stock by conformation.

As well as being a possible measure of production, the shape of the udder is important from this point of view. There are good producers with capacious but otherwise badly-shaped udders; such udders are more subject to injury. Each quarter should be evenly developed and the udder should not be pendulous or cut up. The properly-built udder is protected from injury, is not so likely to be stepped upon and is much easier to keep clean. It is usually in the udder that cows show the first sign of unsoundness. Again, with the advent of the milking machine, the correct placing and size of the teats is a matter of great importance.

With regard to the economic utilization of food, it is essential that a dairy cow should have plenty of capacity—both of chest and of digestion. A high producer may occasionally be flat in the rib, but it is seldom that she is an economic producer of milk when examined from the point of view of food consumption.

The saner objections to the show standards have centered around such descriptions as a "clean cut feminine head with plenty of character and style, plenty of width between the eyes, etc., etc." Whether there is any correlation between these qualities and milking capacity has never been directly scientifically determined. No one will dispute, however, that the appearance of the head of a cattle beast gives an indication of sex whether the

animal be bull, steer or cow; but this indication is not infallible. There are cows with heads like steers. Likewise there exists effeminate bulls. If, in an animal of either sex the reproductive organs cease to function fully, then, in accordance with the degree to which sex organs are upset, the appearance of the animal changes in the direction of an intermediate or neuter type, or may even approach the type of the opposite sex. Thus, the appearance of an animal is governed by the functioning of the sexual organs, which also govern both milk secretion and fertility. Hence it is not illogical to assume, as practical breeders have done, that there is a valuable connection between the head, as an indication of sex and the economic worth of a dairy cow.

To sum up the scientific evidence it may be stated that the existing method of the breeders, based on a correlation of form with function, is not unsound. While conformation of the dairy cow may give small indication of the capacity of the organs of milk secretion, it is of definite value as regards other qualities that are of prime importance from the standpoint of lifetime production.

It is perhaps the showring that most requires adjustment to modern conditions. More emphasis needs to be laid upon definite evidence of milking capacity before a cow can be entitled to the prefix "dairy." There should be more place given to tests of families, daughters of one sire, etc. Also there should be a class for cows that have given over 100,000 pounds. When shows were first started the educational aspect was first and foremost in the livestock exhibits. Our show societies have not forgotten this, but they can advance still further.

It must be admitted that in every breed of livestock there has been a period when the principal breeders set undue store by some character whose economic worth was trifling. That some breeds diverged further than others from the economic path is probably the reason for the present criticism, but does not justify the conclusions at which the critics are arriving.

Wheats That Fool the Hessian Fly

Condensed from Successful Farming

John A. Bird
Kansas State College

WHEATFIELDS have long been the scene of one of the most extensive and hotly contested of battles between men and an insect, the Hessian fly.

The pest was probably brought to America in straw bedding used by the Hessian troops during the Revolution and, since first noticed on Long Island in 1779, has advanced steadily westward with the wheat belt.

First major attack was made at the eastern edge of the Great-Plains wheat belt in 1871, just about 100 years after the flies first began to riddle young growing wheat along the Atlantic Coast. Since that time there have been nine serious outbreaks in the belt, each occupying from two to six years; and in each succeeding attack the damage has been greater, reaching colossal proportions in the five years 1912-17, when the fly subtracted at least $55,000,000 worth of wheat from the fields of Kansas alone, and in 1925, when it wiped out some 40,000,000 bushels in one season.

But agricultural research men were not idle all this time that the Hessian fly was spreading. They advised farmers to curtail damage by early plowing-under following harvest (the Hessian fly is such a weak insect that it cannot work its way up through the soil), with complete destruction of all volunteer wheat. Most important, they recommended that planting be done at the date determined for various regions as the fly-free date, or the date after which the wheat would escape having eggs (which will survive the winter as pupae) laid in it by the fall brood of the fly.

Certainly, widespread damage brought general adherence to the policy of planting after fly-free dates, sharply limiting the immense damage of which the fly is capable. But even though there have been no general epidemics since 1925-26, occasional damage evidenced by withered leaves, lodging, and dwarfed and dead plants may be seen throughout the wheat belt almost any year. Plant-breeders also started a program to build fly-resistance

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into wheats more than 20 years ago. They knew what was needed.

The job is now nearing completion. Farmers in eastern Kansas are growing an extremely high-yielding, semi-hard variety of winter wheat, Kawvale, that shows a strong resistance to Hessian fly in the hard winter wheat belt. In special nurseries devoted to Hessian-fly research at Manhattan, Kansas, and Springfield, Missouri, brand-new hybrids are being tested which show themselves to be highly resistant.

Dr. Reginald H. Painter, who has taken an important part in the battle both as a plant-breeder and an entomologist, recently took me to the plots of the Kansas Agricultural Experiment Station at Manhattan, where the new fly-resistant hybrids are undergoing rigorous tests. He told me of the long and complex job of plant breeding that has been involved in attaining a genuine workable Hessian-fly resistance.

"It may be several years before we release any of these new wheats to farmers," he emphasized as we looked over the hundreds of rows where some 30,000 wheat plants are being tested under heavy infestation. "You see, we've got fly-resistance—plenty of it—but a modern wheat has to have a full set of other qualities as well. We're now making sure that our hybrids have such characteristics as a short, stiff straw; resistance to rust; and the ability to produce good yields of grain that will make a high-quality flour."

"Not all of them come up to the requirements, of course. If the more promising hybrids don't have certain qualities, such as a good flour, we are crossing them back to good varieties that do, and selecting progeny that have both the fly-resistance and the other characteristics we are seeking."

Unfortunately, none of the strains that produce the premier bread wheat seemed to show resistance. In fact, Kanred and Turkey, the principal bread wheats of Kansas, are among the easiest of the Hessian fly's victims. But piece by piece evidence against the fly has been accumulating. At Kansas State College more than 500 strains of wheat were tested, beginning in 1916, and the variance in resistance to the fly recorded. Significant among this data was the fact that the higher resistance seemed associated with some of the soft wheats and the durums.

A valuable crop came about in 1918 when Dr. John H. Parker selected the previously mentioned new variety known as Kawvale. The new wheat had semi-hard grain, yet its parent

was Indian Swamp, a soft-grained variety. More surprising was the fact that, when the new wheat was put thru the test for susceptibility to Hessian fly, it proved to be the most highly resistant of the lot! In fact, it registered infestation of only 1.4 percent in the same tests in which Kanred, a standard variety, had 41 percent damage.

However, it wasn't long until the resistance proved to be only regional; it was resistant in the hard-wheat belt, but in areas where soft wheat is grown, it became susceptible. Here was another puzzle.

Doctor Painter considered this evidence and in 1931 presented the theory that the strange behavior of Kawvale was due to more than one strain of fly. In other words, Kawvale was resistant only to the fly inhabiting the hard-wheat belt, but not to the fly which had preyed for centuries on the soft wheats.

Then he and Doctor Parker looked over the situation and decided that a dash of resistant durum blood in some good, hard-wheat hybrids might do them some good where the Hessian fly was concerned.

That hunch proved 100 percent correct, for from it have come the truly remarkable resistant hybrids previously mentioned. Parker and Painter found the fly-resistant durum blood they were seeking in Marquillo, a cross between Iumillo durum and Marquis. It proved to be a mighty effective antidote.

"Finding Marquillo was only the beginning of the program," Doctor Painter told me. "Marquillo is a spring wheat, but we have to have a hardy winter type. Marquillo has a large amount of carotene in its berry and that makes its flour yellow; we need a whiter flour. However, on the credit side it has a stiff straw and resistance to both stem and leaf rust. Consequently we have to mate it with a winter wheat that can supply what it lacks."

These Marquillo hybrids are tested at Manhattan, in the hard-wheat belt, and at Springfield, in the soft-wheat belt, to assure selection under all-around fly conditions. To assure uniform infestation, stubble in which flies are thriving borders the test plots. Mr. E. T. Jones, of the Bureau of Entomology of the U. S. D. A. is co-operating with Painter and Parker in this testing work.

As I walked thru the plots with Doctor Painter my eyes found proof that the old enemy of wheat can be balked with the unseen but formidable resistance that Parker and Painter have captured from Iumillo durum and have brought down thru Marquis to good types of winter

wheats. Here were the check rows of standard hard wheats, littered with markers indicating infested plants. To Doctor Painter's trained eye the markers weren't necessary, since he could spot the signs of the fly: the broader, greener leaf that means a later yellowing. Under his directions I stripped back the leaf sheath of several of these and found the bulging, glistening, white larvae that had worked down the stem and, by rasping on the straw and sucking up the sap which oozes from the irritated surface, were absorbing the plant's food. But beside these rows that would soon succumb to the fly were the hybrids, and it was easy to tell which of them had captured the resistance of their Marquillo parent; they were marked with few or no stakes, their leaves were a healthy green and showed no signs of shriveling. Selection under a constant barrage of Hessian fly had left for the most part only the strong hybrids, whose infestation runs surprisingly low. In their sturdiness one can see the promise of future freedom from the huge annual tithe that this wisp-like fly and its minute larvae extract from the wheat-growers.

The breeding of resistant hybrids has progressed enough that now some 326 individual selections, stemming from the five most promising crosses of Marquillo to winter wheats, have been promoted to eight-foot rows in the advanced nurseries. Counts last fall showed that under a heavy infestation at Springfield, 236 of those rows were fully as resistant as their Marquillo parent. Less than one percent fell into that range of "susceptible" plants.

The following table, showing the comparative resistance that the new hybrids have gained, would indicate the Hessian flies may have to carry their own rations when they visit:

Percentage of Infestation—1936

I. At Manhattan, Kans. (Hard-wheat fly)

II. At Springfield, Mo. (Soft-wheat fly)

Parent Stock	(I)	(II)
Marquillo	.6	.8
Illini Chief	0.0	94.0
Kawvale	1.9	77.0
Tenmarq	35.0	80.0
Minturki	41.0	89.0
Oro	61.0	88.0
Outstanding Hybrid Families		
Marquillo x Kawvale	1.2	1.2
Marquillo x Oro (resistant to rusts and to stinking smut)	2.7	3.3
Marquillo x Tenmarq (second highest fly resistance in 1935)	1.0	1.3
Kanred x Hard Federation x Marquillo	5.1	4.1
Marquillo x Minturki	9.5	1.5

The Value of the Beaver

Condensed from The Dakota Farmer

E. G. Adams

Assistant Director, South Dakota Department of Game and Fish

FEW people are acquainted with the life and habits of the beaver. Yet no other land animal has been so closely associated with the history and economic development of the North American Continent as has the beaver. The early explorers of most of this continent were the fur trappers, and the principal object of their search was the beaver. The trappers were followed by fur traders who established trading posts and made the first permanent settlement in many places where now thriving cities are found. The foundation for many American fortunes was laid in the fur business.

Because of the value of beaver hides and the ease with which these animals could be taken, it was not long until they were almost exterminated. Although, in the beginning, they were found in practically every part of North America, their numbers had been so reduced that there were only a few scattered specimens twenty-five or thirty years ago. Because of the protection afforded by our game laws, beaver have been increasing at a very gratifying rate and today there is hardly a stream of any consequence in South Dakota that does not have at least one colony of these valuable and interesting animals. There is no open season for the taking of beaver in South Dakota, and they may only be taken under special permit issued to the land owner when they are doing damage to his property.

When beaver are damaging property and complaint is made to the Department of Game and Fish, an effort is made to live-trap and move these animals to a locality where their work will be more appreciated. During the past four years, a little over 540 beaver have been live-trapped and moved by our department. Most of these were placed in the headwaters of the Black Hills streams and elsewhere in the state where their work has been of great value during the drouth of the past few years. The dams made by the beaver have furnished watering places for live-

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stock and game, as well as saving thousands of fish in the beds of streams that would otherwise have been completely dry. In the two national forests in the Black Hills, careful studies have been made of the economic value of beaver dams and it has been found that trees, as well as shrubs and other vegetation have made considerably greater growth in the vicinty of beaver dams because of the sub-irrigation of the soil and the decided increase in the humidity of the air. Water has been stored in these dams that would otherwise have run off and been lost in the spring freshets.

On request of land owners, trapping permits may be issued, allowing the taking of a specified number of beaver during the time when the fur is of the greatest value. A 50-50 division of these hides so taken is made with the landowner and metal tags showing the legality of the hides, as well as selling and shipping permits, are furnished the landowner without cost at the time of division of the hides. The records of the Game and Fish Department show that approximately 800 beaver were legally taken in South Dakota during the 1936-37 season. Since the landowner or trapper received half of these hides, approximately 400 beaver hides were sold, netting the owners about $3,500.00. Thus, a tidy sum is added to the income of a number of South Dakota residents.

There is no doubt about the beaver causing some damage when their numbers increase in any locality beyond the point where the surplus should be removed, but with sensible management there is room for many more beaver in this state, and if the fur crop is harvested wisely, the cash return can be built up to a very attractive figure.

Much of the complaint regarding beaver damage has been stirred up by professional trappers, and it is a peculiar coincidence that about ten times more complaints are received during those months when the fur is at its best than during the other months of the year. While it is true that beaver cut a great number of trees throughout the state in the course of a year, at the same time these trees are principally fast-growing trees such as cottonwood or aspen, with little value except as windbreaks or firewood. In most cases, the trunks of the trees are left after the bark and branches have been removed by the beaver and may be used for firewood. Usually there is enough reproduction of trees brought about by the water-conserving habits of the beaver to more than offset the trees cut each year. This is shown by the fact

that there were no areas denuded of trees by the beaver before the coming of the settler, even though the beaver had been living along the streams for hundreds of years.

Because of the fact that most of the work of the beaver is done at night, very few people have had an opportunity to observe the actions of the beaver. During the summer months, the food of the beaver consists of roots, grasses and tender willow shoots. In the early fall, they usually start cutting larger trees and storing away the limbs and branches for use during the winter. The beaver feeds on the bark of such trees as cottonwood, aspen, ash, willow, etc. After they have eaten away the bark and the soft, pulpy cambium layer, they use the wood that is left for building material for their dams and houses.

Considerable ingenuity and engineering skill is displayed by the beaver in the locating and building of their dams. The dams are plastered with mud on the upper side to make them impervious to water, and they are so strongly built that they will withstand heavy floods.

Sometimes, beaver make their dens in the banks of streams and at other times they build large houses of sticks and logs—plastered with mud—out in the pond created by their dams. In all cases the entrance to the house or den is beneath the surface of the water. The interior of the house or den consists of a single large room above the water-line. There the beaver spends most of the daylight hours and in these homes the little beaver are born, usually about May 1st.

The young beaver, called "kits," weigh about one pound each at birth and there are usually four in a litter. They are covered with fluffy down, much like a young goose, and this coating of hair is so fluffy and buoyant that they are unable to dive or submerge themselves in the water until they are about a month old. When fully grown, the average beaver will weigh from 50 to 60 pounds, while some have been caught weighing as much as 70 or 80 pounds.

During the summer months, the males and the yearling beaver of both sexes will sometimes wander several miles from the home colony but with the approach of fall they rejoin the females and their offspring and all set to work to lay in a supply of food which can be reached during the winter months after the ice has formed over the surface of the water.

The beaver have a broad, flat, paddle-like tail, which they use as a rudder in swimming, and as a brace when sitting upright. A great many people have a mis-

taken idea that the tail of a beaver is used as a sort of paddle or trowel for carrying or smoothing the mud on their dams and houses, but this is not the case. The tail is also used to sound an alarm signal when disturbed, when it is brought down smartly upon the surface of the water.

When the beaver is killed for its fur, the skin is cut around the feet and tail and a single incision is made from the chin to the base of the tail. The hide is then removed and stretched out to dry in as nearly a round shape as possible. When the hide is tanned, the long brown outer guard-hairs are plucked out and only the soft, thickset, downy under-fur is left.

Beaver fur is very durable and will stand a great many years of hard wear when made up into coats or other garments. The color ranges from a light silvery gray to a very dark brown. From 10 to 12 average-sized beaver hides are required for the making of a ladies' full length coat. During the past season, the raw hides sold from $6.00 to $16.00 each, depending on the size of hide and quality of fur.

Like most other wild creatures, the beaver has a number of interesting habits and characteristics and usually, when we learn more about these wild creatures, we are less inclined to want to destroy them.

Taking the If Out of Farming

Condensed from Popular Mechanics

THE farmer is probably the world's greatest gambler. He has to be. His is a life of perpetual uncertainty. "If"—that's the little word that plagues him night and day.

If his seed is infected, there is no crop. If it doesn't rain, there is no crop. If it rains too much, there is no crop. If insect pests overwhelm him, there is no crop. And if he does get a crop despite bugs, droughts, hail, floods and frost, he still may lose money on it if the price isn't right.

Some of the biggest "ifs" of agriculture are being eliminated today by the industrial chemist, who not only assists the farmer in raising his crop, but also helps him sell it.

First of all, the industrial chemist is providing new and steadily expanding markets for

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farm products by finding new uses for them. By chemical skill, for example, he converts cotton into a man-made fabric, a lacquer, a plastic or some other thing of beauty and utility. And the more substances the chemist makes out of cotton, the greater is the demand and consumption.

So efficient have chemists become in utilizing farm products in industry that men of vision see the day approaching when more farm crops will be consumed by the factory than are consumed as food. Feeding the world then will be only a part of the farmer's job. He will become essentially a manufacturer, turning out the raw products required by industry.

But expanding the market for farm crops is just part of the industrial chemist's service to agriculture. He is also providing crop insurance for the farmer. Thus far, he hasn't been able to control the weather, but he has succeeded in eliminating or greatly decreasing other hazards the farmer faces. He has become, for example, the Nemesis of the innumerable pests which bedevil man, particularly the man engaged in farming.

Pests compete with man for his very existence. They attack from the air, the soil and the water, destroying man's plants, his animals, his food, his clothing, even his shelter. In order to exist, man must wage continual warfare against insects, rodents, fungi, bacteria, weeds and a host of other destructive agents. Insects alone cause an annual loss in the United States estimated at $2,000,000,000 and losses to agricultural products caused by fungi and bacteria are estimated at $1,000,000,000 a year. And the loss due to weeds, including actual damage and cost of control, is estimated at about $3,000,000,000 a year.

Pest control with the aid of chemicals is not new. Arsenious oxide mixed with honey was used as an ant poison in the seventeenth century. In the past, however, most poisons used against insects have also been poisonous to man. Today chemists are seeking and finding insecticides of a different kind, substances deadly to insect pests but non-injurious to man or plants.

They are seeking these dusts, sprays and repellents among organic, rather than inorganic substances, animal and vegetable products. Vegetable products in particular offer great possibilities as insecticides either directly or as the starting point for the preparation of synthetic compounds. Many insecticides used today are derived from such plants as tobacco, pyrethrum, cube, hellebore, larkspur, quassia, red cedar and other plants from which essential oils can be

obtained. The finding of rotenone, highly toxic to some insect pests but of low toxicity to animals, in the devil's-shoestring indicates how common weeds yield insecticides. Thus chemistry puts one pest to work eliminating other pests.

Many of the most destructive plant diseases are transmitted on, in or with the seed and one of the chemist's most important services to the farmer has been the development of seed disinfectants and also soil disinfectants to control certain soil-borne diseases of plants. Accident was largely responsible for teaching man how to control wheat smut and this started him searching for methods of control for other plant diseases transmitted by the seed. In 1670 a vessel laden with wheat went down off the coast of England. Farmers salvaged some of the grain, found it too saturated with sea water to use for flour, but planted it for seed. And, to their astonishment, they found the wheat from the wreck was fairly free from smut. Soon the brining of wheat became a general practice. Later other substances replaced salt, but all were liquids and involved soaking the seed.

In 1917 Darnell Smith, an Australian, suggested dusting wheat seed with copper carbonate to kill smut spores. Others ridiculed the idea. Might as well dust it with talcum powder, they said. But copper carbonate worked and wheat production during the world war, when every bushel counted, was greatly increased by dusting the seed with it. About the same time it was found that organic mercury compounds were effective seed disinfectants but the cost was high. Chemists began making hundreds of such compounds and modifications of them and found a way to produce them at less cost.

Today those English farmers who sprinkled their grain with sea water, or their sons who waited for hours while the seed soaked in a copper-sulphate solution, would be amazed at the sight of a modern seed-treating plant treating grain as it passed through a gravity treater at a rate of 500 bushels per hour. The cereals are only one of the many kinds of plants now being freed of seed-borne diseases. Cotton, corn, vegetables, flowers, potatoes and many other plants each have their parasites, fungi and bacteria transmitted through the seed. By seed disinfection, science has placed in the hands of the farmer one more effective weapon to take the "if" out of agriculture.

Science and mechanics have joined forces with chemistry in developing methods of insect

control. Each kind of insect seems to have a weakness. Codling moths insist on laying their eggs in the dark—so flood an orchard with lights and the moths won't reproduce. It has been noted that mosquitoes are attracted by the 360-cycle hum of an electric furnace, the heat of which kills them. This may lead to the development some day of an "electric chair" for the exclusive use of mosquitoes.

Experiments also are being conducted with high-frequency electric waves as death rays for insects. It has been found that at a frequency of about 3,000,000 cycles per second, they will kill all insects within their field. Between 12,000,000 and 15,000,000 cycles they kill plants. Perhaps some day it may be possible to use particular cycles to kill particular insects. One method of selective picking of insects is with ultraviolet light. The Japanese beetle, for instance, is responsive to a particular wave length of black light which does not appear to attract other insects.

One outstanding service of chemistry to agriculture has been the development of agricultural explosives. The use of such explosives for removing stumps and stones, for drainage, stream correction, sub-soiling and tree planting enables the farmer to improve and maintain his land today in a fraction of the time and with but little of the human drudgery formerly necessary. In the old days grandfather boasted if he been able to clear forty acres of land during his lifetime—and he had a right to boast. Today thousands of farmers, with the aid of a few hundred pounds of explosives, clear forty acres in a few years of part-time work.

In the development of refrigerants for mechanical refrigeration, the chemist has rendered a service not only to farmers but to city people who consume the products of the farm. Without such a method of preservation, there would be no market for many of the products of the soil. Today mechanical refrigeration is recognized as just as important on the farm where the food originates as in cold-storage plants, retail shops and in the home.

Thus the industrial chemist begins by treating the seed the farmer plants and finishes by preserving the crop the farmer harvests until it reaches the consumer. And each year, in the quiet of the research laboratory, he is finding new substances and new tools to eliminate more and more of the drudgery and uncertainty from farming.

New Way with Rye

Condensed from Capper's Farmer

Glen A. Myrick

HERE is a new management practice to make rye of more value on the average farm. Castyle Fouts, Carroll county, Indiana, who has 50 to 60 dairy cows, pastures rye until June 1, then takes a crop of seed and a crop of straw for bedding. When he stops pasturing it in early summer the rye is only 4 to 5 inches high. At that time, the ungrazed grain has been headed one to two weeks.

Rye is seeded at the regular time in the fall, but at double the usual rate. Cattle are turned on it in the spring as early as it can be grazed. At least one cow an acre is necessary to keep the rye down so it will not joint. If any plants are permitted to joint they will become tough and unpalatable and the cattle will begin at once to graze the field unevenly, eating tender growth and leaving jointed plants. If sufficient animals are kept in a field to pasture the rye down to 3 or 4 inches in height, they will graze the whole field evenly.

Last spring Mr. Fouts had 44 head on 45 acres in two fields. However, the spring was backward, rye made slower growth than usual, and the cows kept it down. One field was grazed at night and the other in the daytime. Smaller areas are more likely to be grazed evenly than larger ones.

Late in May, the pastured rye was only 3 to 4 inches high. Both fields were grazed evenly and all growth was tender. One could find no jointed stalks.

In neighboring fields which had not been pastured rye was 3½ feet high, was headed and starting to bloom. In fields that had been pastured too lightly, some of the plants were headed and others were eaten off to the ground.

Fields seeded double the usual rate make more pasture when cropped short than do those of normal seeding. That reduces the number of acres required to carry a herd.

Fields thus handled on the Fouts farm make about 10 bushels of grain an acre. Straw production also is cut, but the long period of spring grazing makes rye one of the valuable crops it is possible to produce on this dairy farm.

With such a management plan, there is a place for rye on nearly every dairy farm.

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Full-Drawn Poultry

Condensed from Everybodys Poultry Magazine

Roy C. Potts

Division of Dairy and Poultry Products, United States Bureau of Agricultural Economics

POULTRY, like practically all food products, must meet the competition of other foods. It competes directly with other classes of meat, fish, game, and meat substitutes. If it is successfully to meet this competition, consumer appeal must be fostered.

If the poultry industry is to progress, it must keep pace with or in advance of the forward progress in food products merchandising. New uses of poultry, new methods of marketing, new methods of packaging, and new methods of preparing poultry for packaging are the order of the day. A progressively minded poultry industry is needed to develop the possibilities ahead for marketing full-drawn poultry.

In recent years poultry canning has attained a magnitude that relatively few members of the poultry industry realize. Last year there were inspected by the Federal Government 33 million pounds of poultry, most of which was for use by the poultry canning industry. This does not represent all of the poultry meat used for canning purposes, because there are a few canners who do not use Government inspection.

Undoubtedly one of the most important reasons why the poultry canning industry has grown so rapidly in recent years is because the consumer is assured by Government inspection that the poultry and poultry products he buys in cans are wholesome products that are free from disease. Such assurance seems desirable and necessary when it is realized that of the 33 million pounds of inspected poultry, nearly 700,000 pounds were condemned by the inspectors as unfit for food because of disease or other condition. Although the amount condemned represents only two and one-tenth per cent of the entire amount inspected, what consumer would want to take a

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chance on eating poultry that was prepared from any part of that two and one-tenth per cent?

The marketing of Government-inspected, full-drawn poultry, that is poultry carcasses that have been passed by Government officials as fit for human food, and from which the head, feet, and entrails have been removed, makes available to consumers a desirable class of poultry with a guarantee of its healthfulness and wholesomeness.

Twenty years ago, the marketing of full-drawn poultry was considered impracticable. It was stated in Government bulletins at that time that poultry would not keep for a sufficient length of time after the entrails were removed to permit it to reach the eastern markets in wholesome condition from midwestern shipping points.

Those statements were undoubtedly true at that time, but with the recent new developments in refrigeration, improved transportation facilities, improved sanitary methods of preparing the product, and improved methods in handling the product, it has been clearly demonstrated that full-drawn poultry can be packed at country packing plants and marketed in a fresh and wholesome condition in the larger consuming markets in all parts of the country. It also has been demonstrated that drawn poultry can be successfully frozen and stored during the surplus producing season and later marketed during seasons of under-production.

One of the most successful achievements in the marketing of full-drawn poultry is that of a cold storage company in Omaha, Nebraska. This firm began experimental work in the preparation and packaging of full-drawn poultry under Government inspection in the late summer of 1936. The amount of full-drawn poultry that this firm packed the first month was less than 100,000 pounds. The second month it doubled its volume, and the third month it tripled its first month's operation. In the first six months, it merchandised more than one-half million pounds of Government-inspected full-drawn poultry.

The accomplishment of this firm cannot be attributed to luck or to chance. Rather it was the result of a well-planned program that involved a merchandising campaign, a method of operation, comprehensive studies of the keeping qualities of drawn poultry, and numerous experiments in processing and packaging methods. It was realized that the whole experiment would fail if serious errors were made at any point. The achievement was not the result of half-hearted simple or easy methods. It indicates that

the marketing of full-drawn poultry should not be undertaken by a firm which does not have proper facilities in its plant, or cannot give the project the detailed study and care that such an enterprise demands.

At the plant of this Omaha firm a room was provided in which there was proper drainage of the floors, proper water pressure for cleaning, and proper equipment for disinfecting. Cleanliness throughout the operation was required. Only the highest grade of poultry obtainable on the market was used. The working arrangements and the lay-out of the plant were planned so that the overhead costs of the operation were kept at a minimum.

The poultry was graded and that class which was to be used for the packing of full-drawn poultry was hung on a conveyor which passed into the adjoining room where the poultry was graded prior to drawing. In passing through the grading room the poultry was brought to a table where expert "pickers" removed any remaining feathers that had been left on the carcasses. The birds then passed through a gas flame which singed any remaining feathers or fine hair from the carcasses.

After this the poultry automatically dropped from a hook on which it was carried into a tray which passed it on to a corps of skilled operators who removed the head and feet and entrails. The tray with the entire bird on it, including the entrails, then moved to the Government inspector who carefully examined the bird together with the entrails and interior organs to ascertain whether or not there were any symptoms of disease for which the bird should be rejected. Any carcass showing diseased condition was condemned, denatured, and placed in galvanized tanks which went to the incinerator or to a rendering plant.

The poultry that was approved and passed by the Government inspector went to another corps of operators who finished the drawing operation and passed it on to a washing room where it was washed under forced water pressure until it was thoroughly cleaned, both outside and inside.

After they were dried on the drying table, the individual birds were ready for packaging. The giblets were separately wrapped in parchment paper and placed in the interior of the bird. The entire carcass was tightly wrapped in cellophane. Each individual carcass was weighed and the net weight was marked on each bird. The birds were then placed in a fiber box container — six birds in a box. After packaging, the birds were placed in a sharp freezer where they were frozen.

The entire dressing and packing operation was very efficiently handled and from 12,000 to 15,000 pounds of poultry were inspected per day. When new conveyor type equipment is installed, the operation will be further speeded up so that the daily production will be at least a car of poultry (20,000 pounds) or more. Experiments in freezing and marketing full-drawn turkeys also were undertaken by this firm. These also were very successful and several cars of full-drawn turkeys have been marketed.

One of the interesting features in the marketing of this full-drawn poultry has been the fact that practically all of it has been marketed through retail stores that are not equipped with low temperature freezing cabinets. This is significant, for it is contrary to general belief that drawn poultry can be marketed successfully only if retail stores are equipped with low temperature cases.

Experiments have shown that full-drawn poultry dressed and packed under sanitary conditions and handled properly will keep in a perfectly wholesome condition for a week or more when delivered to a retail store where temperatures around 40 degrees Fahrenheit are maintained. As practically all retail stores are equipped with refrigerator cases that can be maintained at this temperature, the marketing of full-drawn poultry as far as the retailer is concerned, is not a serious problem. However, where a lower temperature can be maintained in the cabinet of the retailer, it is undoubtedly desirable that it be done.

The enthusiastic reception accorded full-drawn poultry by the consuming public in the markets where it has been placed on sale has been most encouraging. There are so many advantages in marketing it that it is needless to dwell upon them in any detail.

Probably the greatest advantage is from the fact that the consumer gets the poultry without any odor or entrail taint such as is present to a greater or less degree in undrawn poultry that has been held for a considerable period in storage.

Another important advantage is the fact that Government inspection eliminates all fear on the part of the housewife that the poultry may be diseased. This fear is eliminated because each carcass carries a label that evidences the fact that the bird has been inspected and certified for condition and wholesomeness by the U. S. Bureau of Agricultural Economics.

This poultry can be sold in retail stores with a minimum cost for retailing, because any clerk who is capable of selling an ordi-

nary package of any food product can sell packaged full-drawn poultry. Expensive help in the retail store such as is ordinarily required for meat cutting work and for drawing poultry is not necessary. Unsanitary conditions in the retail market resulting from the drawing of numerous carcasses of poultry are also eliminated. Approximately 25 per cent of the freight charges is eliminated through the removal of inedible portions of the carcass at point of packing. A similar saving may be had in the cost of storage.

The marketing of full-drawn poultry has great potentialities, if properly pursued. Poultry of a high-grade quality should be used. The plant in which it is prepared should be under Government inspection and supervision. Only sanitary and efficient equipment and methods should be employed. A program of merchandising and retail distribution should be worked out in advance of the undertaking of the packing operations. The whole problem should be studied carefully and thoroughly and every care exercised to make the enterprise successful. The marketing of full-drawn poultry, if pursued on this basis, should have great possibilities ahead for the poultry industry.

Treatment for Screw Worms

Condensed from Farm and Ranch

W. E. Dove

Principal Entomologist, in Charge of Division of Screw Worm Control, U. S. Department of Agriculture

INDIANS, Mexicans and pioneer cattlemen in the West have contributed many queer remedies to the list of cures for screw worm infestations in animals. Boiling water, road dust, dry chips, hot lard, axle grease, lamp black, bacon grease, sassafras tea, liquid smoke and sand are only a few of the discarded medicines.

Many animals are injured by mistreatment — that is, by the use of medicines which are injurious. Mistreatment not only injures the animal but causes large, slow-healing wounds which invite further fly attack. One of

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the first materials employed for treating screw worm cases was calomel, which was placed directly in the wound. Later the use of chloroform and carbolic ointments was adopted. None of these substances is now recommended. Peddler remedies should be avoided as they are expensive and often contain harmful ingredients.

The use of stock dip or any other material having a phenol content as a worm killer should be avoided. To use such materials in a strength necesary to kill the worms will burn the tissues of the animal. Slow healing will result; and phenol poisoning, which is accompanied by swollen or stiff joints. may occur. Cresylic ointment or carbolic acid salves are not recommended. Kerosene or gasoline has no value as a killer.

The proper treatment of a case of screw worms consists of two distinct operations. The first is the use of a material to kill the worms, and the second is the application of a material to keep flies away from the wound. Stockmen should avoid medicines which are advertised as curing infestations with one application, or which use only one material both as a killer and as repellent. The worm killer should be a material which will not injure the tissues of the animal, and the fly repellent should also act as a healing dressing for the wound.

The United States Department of Agriculture recommends the use of benzol (commercial, 90 per cent) for the killing of worms in the wound. Benzol is a clear liquid which does not injure the wound, tends to stop bleeding, and produces a complete kill of the worms. Benzol is much cheaper than chloroform, which tends to harden the healing tissues, delays healing, and stimulates the flow of the wound secretions.

Before using benzol, swab the wound with dry cotton to remove any blood or blood serum. Then apply a small amount of benzol either with a rubber bulb syringe or by pouring from a bottle. In his desire to make sure that screw worms are killed, an inexperienced person usually fills the wound cavity with benzol. This method is not only ineffective but wasteful. Screw worms are killed more easily and quickly when only a small amount of the benzol is properly applied. The worms infesting a wound feed in a characteristic head-downward position. They breathe through two small openings in the posterior ends of their bodies which they project above the liquid wound secretions as often as they need air. If benzol is simply poured into a wound, it forms a layer over the secretions and the worms are able to place

their breathing spiracles above the surface of the benzol. In this way they breathe air mixed with fumes of benzol and are not readily affected. In order to kill screw worms at once, benzol should be used in a dry wound plugged with cotton so that the screw worms are forced to breathe the fumes that are comparatively free of air. If they breathe the fumes for only a few seconds, they become stupefied but are not killed. If they breathe them for several minutes, they are killed.

Plugging the wound with a piece of dry cotton will also prevent the escape of any maggots. Leave the cotton plug in the wound and do not attempt to probe the wound or remove the dead maggots. If the wound cannot be plugged, benzol should be applied and a cotton pad held over the wound for about four or five minutes, so that the gas formed by the benzol is breathed by the worms.

Commercial 90 per cent benzol is inexpensive and should not cost over $1 or $1.25 per gallon. In large lots it can be purchased much more cheaply. There are several things to remember about benzol. It is inflammable and must be kept away from fire. As it evaporates quickly, it should be kept well corked. With a syringe 1 gallon of material will treat about 500 small infestations of screw worms. It may be used in killing screw worms in the eyes and ears of animals. It does not mix with blood and should not be used with materials which tend to carry it into the circulation of the blood.

Following the use of benzol for killing the worms, the wound should be given a light coating of pine tar oil, specific gravity 1.065. Pine tar oil serves to keep screw worm flies away from the wound and hastens healing. It also keeps fly eggs already deposited on the wound from hatching.

After treatment the animal should be placed in a small pasture or trap where daily observations may be made until the wound has completely healed. Repeat the application of pine tar oil every day or every other day to prevent further fly attacks.

Infestation of many wounds by screw worms can be prevented by the use of pine tar oil before the fly deposits its eggs. All wounds, cuts and abrasions should be coated lightly with pine tar oil, dehydrated and acid-free, and the treatment should be repeated each day until the wound is completely healed.

Grainless Milk Cows

Condensed from The Western Farm Life

A four-year test on the Lincoln county, Wyoming, experiment farm shows that milk cows which were fed a grain ration produced more milk than cows which received no grain. However, the additional milk produced was not sufficient to pay for the grain.

At the beginning of the test, eight cows similar in age were divided into two groups as near alike as possible with reference to the stage of lactation and general type as well as to milking ability. One lot of cows received a pound of grain for each 6 pounds of milk produced during the milking period, and in the dry period they were allowed 8 pounds of grain daily a head. These cows had alfalfa hay during the period when they were in the barn and a clover-grass pasture during the summer months.

The other lot of cows was given the same feed and care, except that no grain was fed at any time during the four years of the experiment.

The average yield of milk to the cow over the four-year period was 11,179 pounds for the group which received grain. The equivalent in butterfat was 382 pounds.

The animals which received no grain produced an average for each lactation of 10,498 pounds of milk a cow, with a butterfat equivalent of 370 pounds. The grain-fed animals milked an average of 297 days in each of the four lactation periods, and the non-grain cows milked an average of 282 days each lactation period.

Altho there was very little difference in the average production of the two lots of animals, the difference in feed costs made the receipts above feed considerably more for the lot which received no grain. When current prices were used, both for the milk and also for the feed, the net returns over and above feed were $55.16 for each cow in the grain lot and $72.02 a cow each year for the lot that received no grain.

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Slope Usage

Condensed from Soil Conservation

S. B. Detwiler

Soil Conservation Service

SAFE and profitable use of sloping agricultural lands constitutes an important soil-conservation problem. Cultivation of slopes is responsible for severe losses of soil and water; yet the financial needs of the farmer are often such that he cannot afford to retire these lands from tillage and devote them to less remunerative forest or grass crops. Hill-culture research aims to find sound erosion-control practices that will provide the farm owner with the requisite supplemental income from safe use of steep, erodible lands.

In addition to fully conserving the soil and water on sloping farm lands, the purpose is to produce early economic returns from plant products having high potential commercial values such as tannins, oils, waxes, plastics, food, forage, and specialty products which will not compete injuriously with established domestic crop production and marketing.

Agriculture and horticulture apply scientific principles of economic plant improvement but have limited regard for ecological principles in managing vegetative cover. Silviculture is founded on sound ecological management but is limited in the application of plant improvement principles, since forest crops are not primarily adapted to production of fruits, foods, and forage products which thus far have been the main consideration in plant improvement research. Hence, hill-culture research occupies a distinct field of its own, and offers opportunity for real service in the advancement of erosion-control practices founded upon scientific management and use of superior perennial vegetation yielding early and valuable crops on sloping farm lands.

During the past 25 years, rapid progress has been made in the Dutch East Indies and Malay States due to the establishment of hill-culture experiment stations. The chief methods employed are maintenance of shrubby ground covers, especially leguminous shrubs; protective "shade" trees of leguminous species; intensive selection,

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breeding, and testing of crop trees and shrubs; economical methods of vegetatively propagating the selected strains of crop plants; green manure pits, silt pits, simple terraces, and other erosion structures if required; and effective organization, upkeep, and protection of the plantations.

Many excellent perennial plants are now grown as farm crops, but as yet no one has attempted to develop for the United States a complete and scientific soil-saving farming system based on effective integration of such plants. Our factory-like methods of farming are destroying our source of life—the soil itself. Chemistry can aid in making hill culture profitable through devising ways to use our uncultivated plants, species of the fields, woods and thickets. Plant breeding can do even more than chemistry, because so few of our native plants have been worked with seriously for improvement of their fruit, yield and erosion-control qualities.

Superior varieties of nuts are well recognized as a crop for erosible lands. There are a dozen or more recognized varieties of black walnut yielding nuts of high cracking quality, and several good butternut varieties. The Japanese heart-nut is considered by many to be the best of all nuts. Hardy varieties of English walnut grow as far north as Ontario, as do also hard-shell almonds. There are many superior varieties of shagbark hickory, and also a cross between this species and the bitternut which has the rapid growth so often found in hybrids, bears early and yields well of fine-flavored, thin-shelled nuts. Many superior forms of pecan selections have hill-culture value and several pecan-bitternut hybrids appear promising.

Dr. Kent Beattie, of the Bureau of Plant Industry, spent 3 years in the Orient making intensive selection of the best forms of Chinese and Japanese chestnuts and his work will be of especial importance in hill-culture development. A hybrid chinquapin is available, as are also selections of the American hazelnut. Nut culturists predict that continued selection of the American hazel will develop nuts superior to the European filbert, without the damage from blight which often makes filberts hard to grow here. The Chinese tree-hazel and large-fruited forms of beech offer additional opportunities. In warmer regions, pistachio nuts, selected strains of California hybrid walnut, soft-shelled almond, and Jojoba nut have possibilities. The latter grows wild in arid sections and the nut meat contains 50 percent oil similar to sperm oil.

Various pine nuts can be developed for greater commercial use through selection methods. Large quantities of unselected pinion nuts are marketed each year, besides furnishing an important part of the diet of many Indians.

The wild apricot of Turkestan grows in a cold, arid region and yields fruit of surpassing flavor. The pits as well as the flesh are a staple food of the natives, having a well-flavored and nourishing meat. Selections have been made by the Bureau of Plant Industry for fruit having quality, size, and richness of flavor.

Other edible fruits for hill-culture development are numerous. Here special opportunity exists for choosing hardy native trees and shrubs of high erosion-control value and possessing superior fruit for use in jellies, fruit juices, dried fruits and preserves as well as for forage, waxes, oils, and other commercial products. The Hansen bush-cherry has been developed through selections covering 40 generations and has hill-culture value, as do also the selected strains of the very hardy Chinese bush-cherry. The native blueberries, high-bush cranberry, and other viburnums, service berry, various wild plums and wild grapes, and papaw, have been selected for superior fruiting qualities. Selections are available of native persimmon for seedless fruit, large fruit, early and late ripening, and high yield; and hardy varieties of Japanese persimmon grow as far north as Tennessee.

The jujube in the Southwest offers possibilities for development without cultivation. Next to dates, the native persimmon and the jujube have the highest food value of any of our fruits because of their exceptionally high sugar content. Japanese quince grows well without cultivation, is free from the most serious troubles of the European quince, and furnishes industrial products. A native elderberry has been developed that produces heavily. Many superior heavy-bearing mulberries are available, and, like the persimmon, the luscious fruit has possibilities as feed for domestic animals.

All of the Elaeagnus species are good erosion-control plants and several of these bear large, well-flavored fruits, fine for jelly. European dogwood produces fruits as large as pie cherries which are so relished by children and birds that it is difficult to collect seed. Himalayan blackberry and the Oriental trailing raspberry are now in use for erosion-control planting; both are resistant to the troubles of cultivated Rubus and yield marketable fruit in abundance.

Legumes for forage, waxes, insecticides, resins, oils, and tan-

nins are equally extensive. Several of the new shrubby lespedezas have done well in erosion-control plantings, and offer possibilities as ground-cover plants. With valuable new plants of this sort, there are also opportunities to produce seed commercially. The American Genetics Association held a contest several years ago to locate honey locust trees producing thick, sweet pods suitable for a rich food for cattle as well as offering commercial possibilities for resins, wax, and sugar or syrup. Mesquite and carob produce heavy crops of beans in the Southwest that are highly valuable for forage and industrial uses, and can be improved by selection.

Shipmast locust is a variety of black locust which has a tall, clean, very straight trunk suitable for piling, posts, sills, ties, etc. Its ordinary life as a fence post is from 50 to 125 years. It is equal in growth rate to common locust and not subject to as serious borer damage as is the latter. Work done in the Bureau of Entomology and elsewhere indicates possibilities for developing a black locust even superior, for erosion-control purposes, to the Shipmast variety. It is possible to develop a thornless black locust through selection. Special values of locust and other leguminous trees are their protective and fertilizing properties when properly integrated with other trees and shrubs grown for their commercial products.

Tannin-producing crops offer favorable opportunity for the new type of farming. Sicilian sumac is imported by the tanners in considerable quantities and our native sumacs are also used. R. W. Frey, of the Bureau of Chemistry and Soils, believes selections of native sumac can be made to equal the selected Sicilian forms for superior tannin. The Sicilian sumac industry is highly developed and exportation of plants or seed is prohibited.

The entire world uses about 940,000 tons of 25-percent tannin extract annually, of which about one-half is used in the United States. Chemical substitutes for tannin were developed about 1880 and have been in commercial use for the past 35 years; synthetic tannins are used to improve color and accelerate tanning. Mr. Frey does not expect chemicals to supplant the vegetable tannins for heavy leather of which it is estimated that some 350,000,000 pounds per year are made in this country.

At present the United States imports about 50 percent of the tannin materials it uses.

The development of a new domestic tannin crop is of great interest to the erosion-control program, since it offers a chance

to utilize large areas of erosive soils in growing perennial plants high in tannin value. Mr. Frey and other tannin experts consider canaigre, a sour-dock plant native to the Southwest, a worthy possibility. Mexicans and Indians have long used the heavy root of this plant for tannin purposes. The supply of native plants was nearly exhausted by collection and shipment to England and Germany about 50 years ago. Canaigre is recognized abroad as furnishing a first-class tannin. The plant can be grown with or without cultivation over one-fourth to one-third the area of the United States. A program of research on the possibilities of canaigre is now under way in the Department.

The production of holly and other similar plants for Christmas greens is another potential industry for hill culture. Many farmers now secure income from holly greens—estimated at $150,000 per year in southern Maryland. For Christmas holly, the Chinese holly, *Ilex cornuta,* is especially desirable because of its relatively fast growth and handsome berry production, but this species seems best adapted to the drier and warmer regions. Carefully selected native holly trees need to be worked with in the East.

Maple sugar orchards furnish a common example of applied hill culture; maple sirup and sugar now provide regular and important cash returns to many farmers. Underplanting maple orchards with economic shrubs, such as the improved hazel nut, high-brush cranberry, and blueberry, would tend to improve conditions for growth and yield of the maple trees and furnish an additional source of income. A recent study has shown that maple orchards having a shrubby ground cover have better conditions for their growth.

Hill-culture plantings, after the annual crop values of the plants are no longer profitable, may furnish a final income from wood and from home industries based on wood.

There are several trees now planted only for shade and street use that offer opportunities as high-priced specialty woods. The Empress tree, *Paulownia tomentosa,* grows rapidly and has good possibilities for figured veneer, furniture wood, and wood for many specialties, such as jewel caskets, waste-paper containers and magazine racks. The Cedrela, or Chinese mahogany, and the Ginkgo offer other opportunities.

It requires little imagination to see that if man can live well on the very few plants he has sought to improve, then he surely can live better if he will seriously consider the possibilities in the tremendous number of unused

plants at hand for similar improvement. Sufficient numbers of better than ordinary strains of trees, shrubs, and other long-lived crop plants are already available to start testing the hill-culture system of erosion-control farm management. But the real possibilities lie in directing research efforts toward finding and developing the many unexplored sources for better erosion-control plants and their improved uses for combined erosion-control and economic purposes. To this end, hill-culture research in the Soil Conservation Service works in full co-operation with the Bureau of Plant Industry and other plant research organizations of the Department, and with the State agricultural experiment stations, on selecting, testing, and improvement of hill-culture plants, products, and methods.

Storing Vegetables for Winter

Condensed from The Poultry Item

C. H. Nissley

Extension Horticulturist, New Jersey Experiment Station

STORING increases the value of the products grown in the garden because it lengthens the period in which they can be used. Where vegetables are not grown at home they may be purchased in bushel or larger quantities at wholesale price.

The most important vegetable crops which may be stored for winter are beets, cabbage, carrots, onions, parsnips, potatoes, pumpkins, winter radishes, squash, sweet potatoes and turnips. Other crops such as cauliflower, eggplants, peppers and tomatoes may be kept for several weeks after frost.

If vegetables are to be successfully stored, the following principles should be observed:

1. Never handle vegetables when they are wet.
2. They should not be too old, nor immature.
3. Handle every specimen with care because decay usually starts from bruises.
4. If tender vegetables are exposed to frost before they reach storage they are not likely to keep.

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5. Even hardy crops such as beets, carrots and turnips may be injured by freezing.

6. All vegetables should not be stored under the same conditions; some require a cool, moist storage place, others require a cool, dry place, and still others require a warm, dry place.

Ideal home storage consists of a special vegetable cellar partitioned off from the remaining part of the cellar, where ventilation can be maintained to regulate temperature and moisture conditions. If a cool cellar is not available, root crops, with the exception of onions, may be stored in boxes of damp soil or sawdust placed in any room or building where there is no artificial heat and where danger of freezing may be guarded against. The root crops will also keep well in an outdoor pit, provided it is located on well-drained soil.

To make an outdoor pit, a trench about six inches deep is lined with straw or burlap. The beets, carrots, turnips and cabbage are placed in this trench and covered with another layer of straw and burlap, upon which ground is placed in such quantities so as to protect the roots from freezing. One of the easiest methods is to half bury a barrel in a well-drained location and place the vegetables in this barrel, which is laid on the side. After the vegetables are placed in the barrel it is covered with straw and soil until the vegetables are to be used.

The storage room in the cellar should be well ventilated; excessive dampness should be avoided, and a cool, even temperature of about thirty-five degrees Fahrenheit should be maintained. Ventilate when the temperature outdoors is just above freezing; this will help to maintain a cool, even temperature.

Cabbage may be stored in two ways, in the raw state and in the form of sauerkraut. Just before freezing weather, cabbage is ready for storage. The plants are pulled up with the roots and leaves attached. The plants are then placed in a trench with the stems and roots up, so that during wet weather the water will not gain access to the head. As the weather becomes colder, enough soil is placed over the cabbage so that it will not freeze solid. Over-ripe or burst heads of cabbage may easily be made into sauerkraut. Earthen or wooden receptacles are recommended for the making of kraut. The cabbage heads are halved or quartered and the heart cut out. The cabbage is then shredded and placed in alternate layers of six inches of cabbage and a large handful of salt, which is spread evenly over each layer of cabbage. This causes the formation of a brine solution. The

shredded cabbage is then pressed until the brine solution covers the cabbage. After the receptacle has been filled a clean cloth is placed over the top, over which a wooden cover with a heavy stone or weight is placed so as to weight the cabbage down and keep it under the brine solution. The cabbage must go through a period of fermentation before it becomes kraut.

Beets, turnips, kohlrabi, winter radishes, carrots and rutabagas are best stored in moist sand or in tightly covered boxes or crocks. The object is to keep them cool and to prevent evaporation. Under ideal storage conditions these crops will keep until January or February. With the exception of turnips and rutabagas, they should be stored where they will not freeze. In preparing these crops for storage the tops should be twisted or cut off not closer than an inch to the root because if they are cut close to the root too much moisture will evaporate and the roots are likely to shrivel.

Parsnips, parsley, salsify and horseradish may remain in the ground, in which they are grown, all winter. Freezing and thawing of these crops may cause some to decay but the majority of them will come through the winter in good condition. It would be well to cover these crops with a mulch during cold weather. For convenience, these crops may be dug and placed in boxes or in the outdoor trench because it is impossible to harvest them when the ground is frozen solid.

Onions require a different type of storage than root crops. This crop must be thoroughly cured and harvested; dryness is one of the important requisites for storing onions. After curing they should be stored in a cool, dry place. Onions grown from seed keep better in storage than those grown from sets. This crop will not endure alternate freezing and thawing.

Sweet potatoes, squash and pumpkins require a warmer storage temperature than the root crops. These crops are injured by low temperatures and must be protected from frost. Select only mature specimens and handle them carefully because a slight break in the skin may start decay. After these crops have been harvested they should be dried off for a few hours and then carefully laid either in ventilated crates or baskets, and allowed to thoroughly dry. A warm place near the furnace is the ideal place during this curing period. After they have cured they may be kept at a dry temperature of approximately fifty degrees. Winter squash and pumpkins should have at least two inches of the stem attached. Immature specimens will not

keep well and should be used first. Mature specimens will keep until February or March.

White potatoes may easily be kept in storage by placing them in covered barrels or bins, or they may be placed in shallow piles. They will keep best when placed in a cool, moist, dark place.

Celery, leeks, endive and head lettuce may be kept from two to four weeks in a cool storage after taking from the garden. They will endure a light frost but not a heavy freeze. During the first cold spell they may be protected in the garden by covering with straw, burlap, or other material. The plants should never be handled when the foliage is wet.

Tomatoes will keep until Thanksgiving, or later, by picking the well-mature green tomatoes and putting them in the cellar or into protected coldframes. Tomatoes must not be frosted before they are taken into the storage. The green tomatoes may be ripened by exposing them to a temperature of about 60 to 65° and by placing them in total darkness or in subdued light. Tomatoes must be watched very closely when ripened this way.

A Crimson Blanket of Protection

Condensed from Southern Agriculturalist

Hinton Bradbury

Athens, Georgia

THE well known red clay hills of Northeast Georgia are fast turning to another shade of red and farmers have made their greatest crop discovery since King Cotton. The new crop is crimson clover which has proved its adaptation to the soil in four different ways.

This clover completely covers the surface of the soil during winter and spring, preventing the loss of soil as well as making the ground more fertile. At the same time it gathers nitrogen from the air and conserves the soluble fertilizers in the soil.

Ten years ago less than 25 acres of clover could be found in Hart County. Today several hundred Hart County farmers devote much of their land to this crop. Three Hart County men are extensive growers, and one of these planted 300 acres this year.

Records show that Georgia

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farmers saved $30,000 worth of crimson clover seed last year and this year a slight increase over that figure. Hart County growers sold two carloads of seed to a seed company in Knoxville, Tenn.

At the present time the harvesting of seed is the greatest problem to Georgia growers. Three different methods are used in saving seed. These are (1) stripping, (2) mowing and threshing and (3) combining. It is interesting to note that farmers in Northeast Georgia use more than 10 different kinds of implements gathering the seed, most of which were made in their own work shops.

Stripping is gathering the seed by pulling or stripping them from the heads as they approach maturity. This is done by hand as well as by home-made machines called strippers. The machine strippers vary from small hand operated implements to those drawn by tractors or work stock. The smallest strippers cost less than a dollar while those built more elaborately cost more than $100 to build.

The second method of mowing and threshing is cutting the clover as the seed near maturity, raking it into piles and later threshing the seed either by hand or with a grain separator, or clover huller.

The third method is to use a combine to cut and thresh the seed as it moves over the land.

The principal precautions for getting good quality seed are to wait until the seeds are ripe enough to harvest and in this way avoid bad seed or weeds. Crimson clover seed are considered ripe when three-fourths of them will slip. The seeds can easily be pulled from the stem. Fully ripe seed shatter easily when ripe and dry, but less easily when damp. Due to this, growers are usually found in the fields in late afternoon or early morning. A clover grower examines the seed on the blossom each day for several days in order to know at what rate his seed are ripening and the exact days they will be ready for harvesting.

Each of the three methods has its advantages. The threshers and combine get the seed at one operation, while the mower and thresher require two and sometimes three. Stripping and combining can be done only when the clover is fully ripe and dry. And too, a hard rain or wind may destroy a greater percentage of the seed before the strippers and combine can gather them. Many farmers use the mower and thresher for a part of their crop and strippers for the remainder. The use of combines is new, and additional experience is needed before many recommendations can be made.

Hart County farmers say they have never found a way to gather their seed without losing at least one-third of the total yield while gathering.

The simplest clover stripper is a light wooden box with number 20 finishing nails driven one-half inch apart on one side, which will strip ripe seed and allow them to fall into the box.

The simplest of all horse-drawn strippers consists of wooden or metal fingers spaced like teeth of a comb and swung under an old buggy or wagon or hayrake frame. One of the more elaborate is one rebuilt from an old binder.

In mowing or threshing an ordinary mower such as farmers generally use for cutting hay is satisfactory. The seed can be threshed by hand and beat out with a stick or pitchfork or they may be run through a grain separator. Many of the farmers cover their wagon body with screen or poultry wire and in that manner separate the seed from the straw or body part of the clover.

Five years ago less than a dozen Hart County farmers were growers of this crop, but by 1936 clover seed had been sold in all sections and beautiful red blossoms dotted many a countryside, which was formerly a hillside covered with yawning gullies. During that year 5,000 persons gathered in Hart County for the Clover Blossom Festival.

County Agent L. C. Westbrook, known as one of Northeast Georgia's foremost agricultural leaders, and one of the fathers of clover growing, says visitors from 50 Georgia counties and 11 different states have viewed Hart County's vast clover fields.

Crimson clover is being used more and more each year as a grazing crop. Several years of experience have proved that in cold winter months it is by far the leading grazing crop.

It has been proved by experiments that around 60 to 90 days of heavy grazing may be had before stock is taken from the fields to permit clover to reseed. A much longer period may be had if the field is not being saved for seed. Experienced growers report they have found that grazing actually increases the seed crop and makes it easier to harvest. Cattle are removed from the fields before blooms, which contain seed, make their first appearance. Crimson clover sown on Bermuda sod is permanent for pastures and will furnish ideal winter grazing and greatly increase the growth of Bermuda grass during summer months.

As an economical crop clover saves the farmer money. He may grow his own seed and build more land at a small fraction of

the cost of any other crop for which he has to buy seed.

Today one of the farmers' greatest problems is the prevention of soil erosion, although they are greatly aided by the Soil Conservation Service. This clover affords a protective covering for the land during the winter and prevents leaching of soil fertility by hard blowing winter rains. No other crop does its job so well in covering the land as does clover.

As a cash crop, growers have found that their fields net them good cash returns for surplus seed alone. Cash returns range from $40 to $60 per acre, and many times higher.

As a soil builder clover has proved that it will practically double the yield of corn under favorable conditions without any fertilizer whatever. Actual tests have been conducted and it is now known that one crop of crimson clover will add nitrogen to the soil which is equal to 400 to 600 pounds of nitrate of soda per acre. It is an increase in crop yields and a decrease in fertilizer costs.

The place crimson clover has in the 1937 farm program makes it doubly valuable. It simply means that the man who is growing clover can set up a much higher soil conserving base without danger of penalty for failure to reach it.

The clover grower has his own seed, therefore, no cash outlay is required as would be necessary in case he used vetch or Austrian winter peas as the winter cover crop. All acreage seeded to crimson clover in the fall is classed in the program as conserving acreage, regardless of whether it follows cotton or corn or is sown on idle land. If you come up in the fall a few acres short with your conserving base all you have to do is to sow these few acres in crimson clover.

Farmers Get the Jump on Fire

Condensed from Pacific Rural Press

Loren S. Bush

Chief Engineer, Board of Fire Underwriters of the Pacific

IT has been estimated that over one-third of the area of California, excluding deserts and National Forests, is covered by fire protection. There are more than two hundred rural fire trucks in operation. Of the fifty-eight counties in the state, eight are wholly protected and twenty-five others have partial protection. This is a long step from the situation only ten years ago when practically no protection was available in the rural areas. It is a longer step to our ultimate goal of having all burnable property in the state under some form of fire protection.

Like most programs of fire protection and prevention, the rural protection of California was stimulated by a number of serious fires occurring during the summer of 1928.

Prior to that time, there were some fire-conscious farmers who had equipped water barrels with hand pumps and spray hose and mounted them on skids which could be readily transferred to a truck. A later development was to mount this equipment on a trailer and provide a can for wet sacks. Other communities provided trailers with a battery of 2½-gallon extinguishers and a few of these are still to be found doing active service. To those who initiated this crude form of protection should go much of the credit for subsequent developments.

The first tank truck was built about 1923. It consisted of a large oil tank, and a small pump operated by an unreliable two-cycle engine mounted on the running board. The truck was seriously overloaded and had other undesirable features.

The summer of 1928 was marked by an epidemic of serious fires, especially in the grass and grain territory. One of these fires traveled 25 miles through growing grain with a front from six to twelve miles wide. As a result of these fires, it appeared that the farmers would have considerable difficulty the following year in placing fire insurance on their growing grain. The insurance companies had consistently paid out more in losses than they

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had collected in premiums, and the situation became so grave that the governor of the state appointed a committee from his Council to see what could be done toward protecting this type of property in the future. The Board of Fire Underwriters of the Pacific was called upon to meet with this committee in working out plans for fire protection.

With assistance of the College of Agriculture, the State Forester and other state officials, a tentative program was drawn up and submitted before a meeting of all those interested in the subject. This was the beginning of the California Rural Fire Institute which is sponsored by the Department of Agriculture of the University of California. This organization compares in a small way to the National Fire Protection Association, as it acts as an advisory body and draws up standards for rural fire protection in California in much the same way that the N. F. P. A. provides standards for the entire country on all fire protection problems.

As a result of the work of the Rural Fire Institute, standards were published covering the organization of rural fire departments and the specifications for fire trucks. These standards were primarily designed for combating grass and grain fires, although some equipment was included in the specifications for fighting structural fires. It was found that the equipment was doing remarkable work in stopping structural fires in the rural areas, and in 1932 the specifications were changed to include three types of equipment to correspond to various local conditions.

All of these three types of equipment have some general requirements in common, as it is necessary, for instance, to carry water tanks on all rural fire trucks with a pump designed to take suction from the tank and discharge through small hose lines. The size of the water tank and capacity of the pump, however, depend upon where the truck is to be used. In level country where the principal values are in buildings, a large truck carrying at least 300 gallons of water, a supply of 2½-inch hose, and a pump of approximately 500 gallons per minute capacity is recommended. In the valley where grain is the principal item to be considered, the requirements call for a slightly smaller truck carrying at least 250 gallons of water and a pump of at least 100 gallons per minute capacity. In mountainous country where mobility of the apparatus is of prime importance, the specifications recommend a small truck carrying 150 gallons of

water and a pump of at least 30 gallons per minute capacity.

Some rural departments have made extensive surveys of their districts and have installed a complete card index of every farm. These cards have a small map showing the proper route to take in order to reach the property as well as showing all buildings and location of water supplies. When an alarm is received the card is taken from the file and carried by an officer in charge to the fire.

The method of receiving alarms is even more important in rural protection than in cities. The telephone must be depended upon to a large extent for this function. In some districts cards are placed on every phone giving instructions on how to report a fire. Where telephones are scarce, lookouts are stationed on towers or mountains. These are of particular importance for grass and grain fires, but have been used to detect structural fires. Each tower is equipped with a map, and by sighting the fire over the map the exact direction can be determined, which is telephoned to headquarters. After receiving reports from two lookouts the exact location of the fire can be determined.

The entire plan of maintenance and support for this protection is based upon state laws, which provide for the organization of fire districts under the supervision of the county. Under the laws, financial support is provided by a tax levied against all assessable property within the district. A district may be disorganized in much the same way that it is organized—that is, by a vote of the people. It is interesting to note, however, that of all the rural fire districts organized in the state, not one has ever been dissolved.

Some communities operate on a voluntary basis and finance their fire protection by public subscription. In general, this does not prove satisfactory due to the fact that in a year or so subscriptions become hard to collect and those interested in maintaining the fire protection become discouraged.

In promoting rural fire protection, we have, wherever possible, recommended that a city or town fire department form the nucleus for the rural organization. In this connection it might be stated that although the organization of a fire department is just as essential as the furnishing of equipment, it is one of the most difficult things to obtain in rural areas. If a town department can be used to operate in the country, it solves the problem of organization and also solves for the city the problem of responding to fires outside its limits.

Since becoming interested in rural fire protection in 1928, the Board of Fire Underwriters of the Pacific has attempted to make some recognition in the fire insurance rates of the good work accomplished in rural areas. The first credits were given on growing grain only, and were based upon the completeness of the fire protection provided. The maximum credits at that time were 16½ per cent. After observing the good work on structural fires, it was decided to give some recognition in building rates in protected rural areas. Last year the maximum credit on growing grain was increased to 33⅓ per cent and credits were allowed on pasture insurance in the stock country.

In order to determine the value of the protection, gradings are made of each district. This consists of comparing the protection provided with definite standards and considers such items as personnel of the department, drills and training, organization and fire methods, apparatus, minor equipment, distribution of companies, means of receiving alarms, inspections, fire prevention laws, and records. From this grading the district is placed in one of five classes according to the score made, and credits in rates are allowed according to the classification.

The loss ratio in Kern county on farm property alone for 1932 was 166.5 per cent; in 1933 it was 107.3 per cent; in 1934 the fire protection began to operate, and the loss ratio dropped to 24 per cent.

We may conclude that five things are essential in obtaining rural fire protection. First, there must be a desire on the part of the public for this protection. If this is not manifest, there is little use in going further. Second, adequate laws must be enacted for the acquisition, maintenance, and support of the protection. Third, there must be a good fire department organization. Without this there is little use in obtaining the fourth requirement which is equipment properly adapted to local conditions. The fifth requirement is water supplies available to the department either through pumps, reservoirs, or connections to domestic supplies.

A Probable Cultural Control for the Pale Western Cutworm

Condensed from Scientific Agriculture

H. L. Seamans

Dominion Entomological Laboratory, Lethbridge

SINCE 1911 the pale western cutworm (*Agrotis orthogonia* Morr.) has been a serious pest of crops on the Canadian Prairies. Extensive experiments have been conducted in attempts to find a successful control for this insect. Since 1921 a prevention of infestation in summer-fallowed fields has been practised with exceptionally good results, and since 1923 outbreaks have been forecasted with reasonable accuracy. While these two measures have served to reduce greatly the annual damage, the losses to crops seeded on stubble or on land which has received drifted soil have continued unabated.

Field observations made during the last fifteen years have shown that occasionally there was some combination of circumstances which appeared to control the insect, and attempts have been made to determine these circumstances. A recent study of the insect in detail has shown that the eggs hatch as soon as the frost is out of the top two inches of soil, provided there is moisture present. The newly-hatched larvae may live for several weeks in the cold soil, and they begin feeding as soon as vegetation starts to grow. Laboratory experiments conducted during the past year have shown that newly-hatched larvae can withstand long periods of starvation when kept cool, but having once fed they succumb in a few days if no more food is available. Older larvae can withstand from two to three weeks' starvation.

During the spring of 1936, field experiments were conducted to determine the practicability of producing a starvation period for first and second instar larvae by cultivation to destroy vegetation and to delay the seeding of the new crop. Two fields of 640 acres each, which had been seeded to wheat in 1935 and were severely infested with first instar

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cutworms were chosen. The first of these was cultivated within a three-day period with a one-way disc. After a delay of one day, seeding was started across the direction of cultivation, which provided 12 plots of a little over 53 acres each, with the different periods of delay between cultivation and seeding varying from two to thirteen days. The second field was cultivated with a one-way disc and no seeding done for ten days after the cultivation was completed. Seeding in the first field was completed on April 29 and in the second field on May 19.

In the first of these fields, cutworms seriously injured the crop on all plots with less than a five-day delay between cultivation and seeding. The rest of the plots showed little or no damage and few cutworms were present. In the second field the cutworm loss was less than one per cent, and larvae were very scarce.

A re-study of the field histories which have been taken over a large portion of Alberta and Saskatchewan since 1921 was made with delayed seeding in mind. Only fields on farms where some cutworm damage occurred and which definitely showed that a delay had or had not occurred between cultivation and seeding were considered. These fields were divided into two groups, those which showed a delayed seeding and those in which cultivation and seeding were done at the same time. Because larvae beyond the second instar can withstand longer periods of starvation than those in the first two instars, the fields showing delayed seeding were also divided into two groups. The first of these contained fields cultivated and seeded before May 15, and the second group contained those fields where the seeding at least was done after May 15. Unfortunately there is nothing in the records to indicate how many days occurred between cultivation and seeding, and the cutworm losses which occurred may have arisen from the fact that the delay was of short duration.

The results of these field history studies are as follows:

Classification	Total fields	Total acres	Acres destroyed	Per cent damage
Delayed seeding, early	31	1,869	254	13.05
Delayed seeding, late	56	2,551	741	29.04
Simultaneous cultivation and seeding	263	12,299	6,705	54.51

These records indicate that over a period of years, when seeding followed at an interval after cultivation the loss caused by pale western cutworm was greatly reduced, particularly if the cultivation and seeding were done early.

During the season of 1936 a few farmers were interviewed who have consistently grown crops on stubble without cutworm losses, in the midst of areas of severe cutworm infestations. These men have all followed the same practice in their fields. All stubble to be seeded is cultivated early to destroy volunteer growth, and seeded from a week to ten days after the cultivation.

The results reported indicate that this practice might be of considerable benefit. One thing is certain, the damage will not be any greater if seeding is delayed, and it may be considerably lessened.

Finishing the Hogs

Condensed from The Southern Planter

B. E. Carmichael

PROPERLY fed and managed, the hog is an efficient converter of a wide variety of farm-grown and commercial feeds into highly palatable nutritious food for human consumption.

There are a number of good reasons for the high place taken and held by the hog as a food producer in America. Reproduction is quick and abundant. Capacity for feed consumption is large. Many different kinds and combinations of feeds are used effectively by the hog. Gains in weight are rapid and economical. The pig may be slaughtered for home use, or marketed at an age, weight and degree of fatness to meet any reasonable preference for weight and finish. The proportion of carcass yielded at slaughter is higher than for any other farm animal. The meat is palatable and may be used in a wide variety of ways, fresh or cured, soon after slaughter, or months, or even years, later. The fat yielded by the hog is more valuable than the fat from any other animal carcass. It is no wonder, then, that the hog is high in favor on American farms, especially when it is remembered that he is able to

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thrive under a wide range of climatic conditions and that he will adapt himself to almost any situation with reference to feed, shelter and management.

In order to fatten to best advantage, the hog should be healthy and free from serious parasitic infestation. The use of the McLean County system of sow and pig management, possibly modified somewhat to meet local conditions, involves little or no cash outlay and yields big returns in health and thriftiness of pigs.

Adequate, though not necessarily expensive, shelter from extremes of temperature and from storms should be provided; and there should be an adequate water supply, preferably accessible at all times, as the pig prefers to drink often and little at a time if given an opportunity to do so. Hogs have been known to suffer severely from thirst, when a little attention and effort would have provided water in abundance.

Though some growth can be produced on scant allowance of feed, the pig that is to grow rapidly and fatten at the same time needs an abundant supply of efficient feed. In some localities, special crops that are grown successfully and in a small way may be used in rations for hogs, but the great hog-producing industry of America has been developed chiefly where corn is grown abundantly and economically. The corn-and-hog combination has been of enormous economic importance to both producers and consumers. Corn is palatable, wholesome, convenient to store and feed, and, when properly supplemented, is highly efficient. Moreover, corn yields more pounds of grain per acre than any crop. When fed alone corn is very inefficient. There is not enough of protein in corn to provide for generous growth, and the protein of corn does not furnish all of the amino acids needed for normal growth. Also, corn does not supply enough of mineral matter, being particularly low in calcium.

Other farm-grown grains are fed to a limited extent to hogs, and they have, in general, the same protein and mineral deficiencies as has corn, though not quite to the same extent. It should be kept in mind that neither corn, nor any other farm-grown grain, nor, indeed, any combination of farm-grown grains, will meet adequately the requirements of the young fattening hog, which needs enough of the right kind of protein and mineral matter as well as a generous supply of fat-producing feed if he is to grow and fatten rapidly and economically.

The hog that is to be fattened and slaughtered before it is a

year old—or perhaps before it is six months old—has a far different feed requirement than that of the hog of earlier days that was allowed to grow in a half-wild state until a year or two of age and then was penned for fattening by a short period of heavy feeding on corn alone. As produced under present-day conditions, the hog is being grown and fattened at the same time, and has need for feeds adequate in kind and amount to meet at least fairly well the requirements for supporting both growth and fat production. Unlimited range where an abundance of grass, roots, and nuts may be had for a period of long, slow growth is not now generally available; and, with hogs at such prices as prevail today, the "time of a hog" is too valuable to be expended in any such time-consuming, inefficient method of hog production as once prevailed.

Fortunately, there are available a number of materials which, when fed along with corn or other farm-grown grains, will provide added protein. Some of these feeds are tankage, fishmeal, dairy by-products when available, soybean oilmeal, peanut meal, linseed meal, buckwheat middlings, wheat middlings, and other feeds that contain more of protein than does corn. If feeding is done in dry lot, supplemental feeds which are derived from animal sources, such as the first three in the list, are likely to give better results; but the others will be effective if minerals and leafy legume hay or green feed are given. Soybean oilmeal is so highly palatable that, if it is self-fed, pigs often will eat too large a proportion of it in connection with corn for most economical results; this difficulty may be met by hand-feeding the needed amount, instead of self-feeding.

Giving the fattening pigs access to ordinary salt, steamed bone meal specially prepared for feeding purposes, and finely ground raw limestone will care for most mineral needs. When tankage, fishmeal, or dairy by-products are used, especially if used in connection with good green forage, there is far less need for mineral matter than when high-protein feeds from vegetable sources are used on pasture or in dry lot. Minerals should not be expected to take the place of high-protein feeds in rations for hogs, but they should be provided whenever high-protein feeds from vegetable sources are used to supplement corn. To insure an adequate supply of vitamins A and D, leafy legume hay should be fed to hogs not on pasture.

Some rations that will yield good results in dry lot are:

1. Corn and tankage, self-fed; legume hay.
2. Corn and fishmeal, self-fed; legume hay.
3. Corn, hand-fed or self-fed; ⅜ pound tankage daily per pig; legume hay.
4. Corn, hand-fed or self-fed; ⅜ pounds fishmeal daily per pig; legume hay.
5. Corn, hand-fed or self-fed; ½ pound soybean oilmeal daily per pig; minerals; legume hay.
6. Corn, hand-fed or self-fed; ½ pound peanut meal daily per pig; minerals; legume hay.

In the foregoing suggested finishing rations, ground wheat or ground barley may be substituted for a part or all of the corn; if either of these feeds is used, a somewhat smaller amount of high-protein supplement will be needed than if corn is fed. Ground wheat is equal to corn in feeding value per pound, or a little more valuable. Ground barley is about 90 per cent as valuable per pounds as corn. Ground oats, if of heavy weight, may be used as a substitute for about one-fourth of the corn or other grain, but are too bulky for profitable extensive use unless they can be had for about 70 per cent of the price of corn per pound. If the finishing is done on pasture, only about one-half to two-thirds as much of high-protein supplement will be needed as when the hogs are fed in dry lot.

Contrary to the opinions of some feeders, there is no good reason for penning pigs away from green feed while being fattened. Good green forage in connection with a generous ration, will increase the rate of gain, will reduce by about one-half the amount of high-protein and mineral supplement needed, and will reduce slightly the total amount of concentrates required per pound of increase in weight. Of course, hogs that are being fattened should not be required to travel far for feed. Generously fed hogs that are on green forage will not do much traveling. In addition to the nutritional benefit derived from greed feed, access to fields usually provides better sanitary environment, reduces the labor needed in caring for the pigs, and avoids much of the large waste of manure that so often occurs when pigs are fed in small lots. Of course, a generous ration should be supplied in addition to the green feed if a rapid rate of production is desired.

There is an old saying to the effect that pigs should produce ten pounds of gain in weight for each bushel (fifty-six pounds) of shelled corn consumed, or at the rate of a pound of gain in weight for 5.6 pounds of corn consumed. Many feeding trials have shown that it is now possible to produce from approximately four

pounds of feed, and sometimes from less than that amount, a pound of gain in weight on fifty-pound feeder pigs that are fed to a weight of about two hundred pounds, even when no green feed is available.

There are readily available a number of feeds that are of real merit for use in connection with farm-grown grains. No one feed, and no combination of feeds, should always be depended upon, for market prices and other important factors vary so much from time to time that failure to take them into account may result in unsatisfactory financial returns. This is important, whether hogs are grown in a small way for home use or in a larger way for marketing.

There is no one "best ration" for fattening hogs. Excellent results have been secured from widely varying feed combinations. Best results can be expected only when the feeds meet well the exacting needs of young fattening hogs. If these needs are met, hogs will, if healthy and well managed, produce generous, economical gains in weight.

Why the United States Imports Cotton

Condensed from The Agricultural Situation

Maurice R. Cooper

THE United States imported 253,000 bales of cotton in the 12 months ended July 31, 1937. This was the largest quantity imported in 7 years but it was about one-third smaller than in the years immediately before the depression. Since this country usually produces more than twice as much cotton as it consumes and in recent years has been restricting production, it is not surprising that there should be a great deal of confusion in the minds of many people as to why raw cotton is imported into the United States.

Most of the cotton imported into the United States either differs in quality from American cotton or is needed to supplement certain qualities not produced in sufficient volume to meet domestic needs. Under normal marketing conditions the United States will never import cotton similar in quality to that produced in this country in large enough quantities to satisfy the demands of American manufac-

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turers (except possibly from Mexico because of its nearness). Imports of 250,000 bales are very small in relation to a total domestic consumption of 7 or 8 million bales.

The price of a particular quality of a given commodity in any two important markets cannot, except possibly for short periods, differ by much more than the cost of delivering the commodity from one market to another. The existence of such a condition would make it profitable to transfer the commodity from one market to the other. As a result of this transfer, the supply in the lower-priced market would decrease and the supply in the other market increase. Consequently, the price would be strengthened in one market and depressed in the other. As long as American cotton is exported to foreign countries the price in those countries for a given quality must be higher than in domestic markets by at least the amount of the freight, insurance, interest, and other transfer costs. If at any time the spread between the domestic and foreign price were to differ by less than the transfer costs, there would be no incentive for exporting American cotton. Because of this, exporters of foreign cotton will never, except under very unusual circumstances, find it to their advantage to ship to the United States cotton of the same quality as that being exported from the United States in significant amounts. As long as the price of a given quality of cotton in Liverpool, Havre, or Kobe is higher than the price of this quality of cotton in the United States by an amount equal to or in excess of the cost of delivering cotton from the United States to these markets, exporters of similar cotton from Russia, Brazil, and most other countries would lose money by shipping such cotton to the United States.

More than one-fourth of the cotton imported in recent years was 1⅜ inches and longer in staple. This is longer than any of the cotton produced in the United States with the exception of a few thousand bales of American-Egyptian (Pima) produced in Arizona. Although staple length is generally considered one of the most important factors determining spinning utility of cotton, other factors are also important. It is said that this extra-long staple foreign cotton possesses some other elements of quality not possessed by American-grown cotton having approximately the same staple length. This and the fact that insufficient quantities of this extra-long staple cotton are produced in the United States to meet domestic requirements account for the fact that this cotton is imported

in significant quantities despite an import duty of 7 cents per pound. Most of the imported extra-long staple cotton comes from Egypt and is consumed by the thread, tire fabric, and fine goods industries. It is said to be needed in order to give additional strength to the yarns, particularly those produced for thread and for tire fabrics.

Imports of Egyptian cotton shorter than 1⅜ inches in staple (a very large part of which is 1⅛ to $1\frac{7}{32}$ inches) also account for a substantial portion of the total domestic imports of cotton. This cotton has about the same length of staple as the longer lengths of American Upland cotton, most of which is produced in the Mississippi Delta. While total domestic production of cotton 1⅛ to $1\frac{7}{32}$ inches represents only about 5 percent of the total American crop, it is considerably larger than the quantity of such cotton consumed by American mills. The fact that cotton with these staple lengths is imported from Egypt and also from Peru, despite the 7-cent import duty—at the same time substantial quantities are exported—can only be accounted for by differences in quality factors other than staple length. At least domestic manufacturers or consumers of the products for which the import cotton is used apparently believe that the imported cotton is more desirable for their purposes than the domestically produced cotton. Most of this imported ordinary long staple is also used by the thread, tire fabric, and fine goods industries. However, a large part of that imported from Peru is noted for its rough character, which makes it desirable to American manufacturers for use in asbestos and part-woolen goods.

Most of the remainder of the cotton imported into the United States during recent years came from India and China. Reports on the staple length of this cotton on hand at the end of the season show all cotton shorter than ⅞ inch combined. However, a report released in 1932 on the quality of foreign cotton consumed in the United States indicated that most of the cotton being imported from these countries was shorter than $\frac{13}{16}$ inch and ranged from ½ to ¾ of an inch in staple. Although the United States produces comparatively large quantities of cotton shorter than ⅞ inch, a further break-down would probably show that little American cotton is shorter than $\frac{13}{16}$ inch. The fact that most of this imported extra-short staple is of a very rough or harsh character, however, is possibly of more importance in accounting for its importation than its shortness of fiber. This cotton is said to be used largely

in the manufacture of cotton and part-woolen blankets and other part-woolen goods, because its harsh short fiber gives a desirable feel and appearance to the finished fabric.

There are a few thousand bales of Mexican cotton imported annually, a substantial part of which is believed to be about the same in quality as American cotton. Most of this cotton loses its identity and is apparently sold to domestic manufacturers or is re-exported as American.

Information is not available with respect to the quality of the few thousand bales of cotton imported during recent months from Brazil and Russia, but it is safe to say that this cotton differs in quality from the bulk of the American crop or that domestic importers encountered a temporary and very unusual market situation which made it possible to import this cotton at a lower price than domestically produced cotton of similar quality could be obtained.

It appears, therefore, that a substantial part of the cotton imported into the United States is accounted for by differences in the quality of this cotton and that produced in the United States. Even in the case of extra long staple cotton, which is not produced in sufficient quantities to meet the requirements of domestic mills, there appear to be significant differences in other quality characteristics between that produced in the United States and that imported.

Directing Grazing Habits

Condensed from The Shorthorn World

J. E. Nordby
University of Idaho

THE problem of getting livestock to graze evenly on hilly ground is often a difficult one. For the most part, they will overgraze the higher ground and undergraze the lower areas. This is particularly true on sweet clover forage which often grows very profusely on the lower ground where it is coarser and probably less palatable than it is on the hilltops. Sheep have the habit of grazing the preferred spots so closely that the

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growth of the forage is greatly impaired.

It is well understood that plants which are grazed closely cannot grow so rapidly as plants that are left more undisturbed. This lack of balance in the crop growth on the low and high areas in the field contributes further to the already unbalanced state of fertility in such areas. A large growth of sweet clover builds up the soil faster than a small crop.

The author has observed for a number of years a practice that has been successfully used in balancing the grazing habits and, consequently, the fertility of uneven ground. As soon as the cattle or sheep begin to graze too heavily on selected spots, fresh barnyard manure is distributed thinly with a spreader over them. This will discourage cattle and particularly sheep from further grazing until the sweet clover has grown well above the manurial residue. It is to be observed at this point that the light application of manure will tend materially to build up the organic matter and fertility on the higher ground so a better balance will prevail in the productivity of the uneven ground.

This practice is of especial value at this time when so many hilltops are being seeded down to legumes or perennial grasses under the soil conservation program. The farmer may wish to pasture off the aftermath in the fields in which these small grass-planted areas are located. However, inasmuch as the growth on these plots is more palatable than the browse in the field, the livestock often graze it "into the ground" before they do the right sort of a job on the aftermath. The planted areas are often small, irregular in shape, and too expensive to fence. To preserve them from overgrazing without the expense of fence, the manure application is practical. Almost any kind of fresh manure will discourage sheep. For cattle, it is preferable to use well-rotted mixed manure or fresh cow manure, although fresh horse manure will be very helpful.

Rodent That's Worth More Than Gold

Condensed from Nation's Business

John Angus Haig

WHENEVER Nature has adorned one of her creatures with a beautiful pelt, colorful feathers or anything else that lends itself to the commercial purposes of man, that creature is usually doomed to extermination. There is no want of illustrations.

Our ancestors practically exterminated the beavers to make a lot of ugly hats. The crews of early sailing ships clubbed the last flightless dodo to death on the Island of Mauritius for a certain stone, useful for sharpening clasp knives, that the bird always carried in its digestive tract. The American bison, the passenger pigeon, the flamingo, the scarlet ibis, the plume-bearing herons and egrets, the fur seal of Alaska, the musk deer of the Himalayas, all have either been exterminated or were saved only by intervention of conservators.

Such things were known by M. F. Chapman, an American mining engineer, who was busy taking copper out of the ground high up in the Andes of Chile while the nations of Europe were fighting the most devastating war of history. While his education and business experience had been primarily in the field of geology and mining, his hobby was zoology. For many years he had surrounded himself with pets —almost any sort of a creature he could catch and tame in the vicinity of isolated mining camps where his profession took him.

He had heard of a strange little fur-bearing rodent, the chinchilla, once abundant in the cold, bleak altitudes of Chile, Bolivia and Peru.

By 1915, this animal, cursed by nature with a magnificent silvery-gray pelt, had been hunted and trapped to the verge of extermination. Mr. Chapman longed to catch and tame one. But for several years, he never saw one.

Then, one day in 1919, an Indian rode into the camp of the Anaconda Copper Company at Puertrerillos carrying a live chinchilla in a five-gallon oil tin. The chinchilla had been in the can 17 days, with questionable food and no water. The Indians of South America believe the chinchilla never drinks water, and

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the man who brought it to Mr. Chapman demanded payment for the animal before the engineer risked killing it by giving it a drink.

Not only had the chinchilla been in the oil-can for more than two weeks, it had been transported through altitudes varying from 11,000 to 16,000 feet.

The miserable little creature must have lived in a veritable oven by day and a refrigerator by night. The fact that it had survived was sufficient proof to Mr. Chapman that the chinchilla is a hardy animal that should thrive in captivity under intelligent care.

In this thought he had the germ of an idea, destined insofar as he and his family were concerned to become more valuable than several copper mines.

Mr. Chapman knew the history of the chinchilla's persecution. He knew that, shortly after the turn of the century, several hundred thousand pelts had been exported each year. Chinchilla fur was then an important Chilean industry.

He knew that, by 1915, the number had dropped to fewer than 5,000. By 1917, extermination of the animal appeared so certain that the Government enacted strict laws for their protection.

Mr. Chapman knew that these laws could not possibly save the chinchilla. Man was no longer the real enemy but one of man's blunders was. Some Englishmen interested in sport had brought the European red fox into the country. The foxes were rapidly completing the work of destruction begun by the hunters and trappers.

So, when he acquired a living chinchilla, Mr. Chapman had a vague idea of saving the species from extinction, and possibly, reestablishing the defunct fur industry by domestic production. He grub-staked a group of Indians and sent them off to bring in live chinchillas. In due time he had two dozen Indians so employed—and they combed the Andes for three years before the mining engineer had 11 animals safely in the pens he had built for them at Puertrerillos. Even then, only three of the chinchillas were females!

Knowing that the natives of Tibet dare not drive their yaks down to lower altitudes from 18,000 feet or more without stops for gradual acclimatization, Mr. Chapman arranged a series of stations between Puertrerillos and the seacoast. Then he built an ingenious box with chinchilla pens in the ends and an ice compartment in the middle. In this he housed his precious live stock and came down out of the mountains by a series of short trips. It was a ticklish job, but he com-

pleted the trip in one year with his 11 chinchillas apparently none the worse.

Mr. Chapman was fortunate in being a person of importance in the eyes of various Chilean government officials. Even so, it took weeks of negotiations and diplomacy to obtain an official permit to take one dozen chinchillas out of the country.

The skipper of a Japanese ship was far more difficult. Seeking to avoid trouble, Mr. Chapman and his wife booked a whole deck in the ship. But the captain was obdurate. Rules, he declared, specified that all pets or livestock must be carried in cargo holds. The chinchillas would have to go below, an action which Mr. Chapman knew would be tantamount to heaving them over the side. Something had to be done. Thereupon, Mr. Chapman recruited 11 friends, had each one put a chinchilla in his pocket and come aboard the ship as a farewell visitor. The refrigerator cage was carried into a cabin disguised as a trunk.

With the ship at sea and the chinchillas in a cabin with plenty of ice and electric fans around them, Mr. Chapman served notice upon the skipper that the animals were worth a million dollars. If anything happened to them by reason of the captain's interference, he would libel the ship for that amount and hold it in Los Angeles Harbor until the money was paid.

It worked! Nothing further was heard about chinchillas not being allowed in passenger cabins.

For three weeks, as the ship crawled up through the Pacific, Mr. and Mrs. Chapman took turns standing watch over the chinchillas 24 hours each day, cracking ice, oiling the fans—and praying. They heaved long sighs of relief when, at last, the 11 chinchillas were safely in the pens in the back yard of their home in Los Angeles.

During the next three years Mr. Chapman accomplished a feat of animal acclimatization no less amazing than some of the plant transformations of the late Luther Burbank. One of his most difficult problems was to induce the chinchillas to realign their lives with the calendar of the North Temperate Zone. Arriving in California in February, 1923, the animals were already beginning to put on heavy coats in preparation for the cold Andean winter. By May when Southern California really begins to get hot, the chinchillas were dressed for sub-zero temperatures. They were miserable little animals during the summer of 1923. They became languid and sickly.

During the first year Mr. Chapman was gloomy, perturbed and somewhat discouraged. But

he refused to abandon the experiment. Hope sprang anew when, in 1924, the animals readjusted themselves to the reversal of their calendar. Soon baby chinchillas were running around the pens like animated, down-furred, semi-rabbit-eared, squirrel-tailed, little wood rats.

In 1923, man's knowledge of the habits of the chinchilla was little more than Indian legend and hearsay.

For this reason, every step of the Chapman acclimatization and domestication experiment had to be accomplished by trial and error. There were a thousand problems involving food supply, housing, breeding and adaptations to domestic environment.

The question of proper housing was one of them.

No one knew certainly just what sort of living quarters chinchillas occupied in their native habitat, although there was reason to believe that they lived in natural holes or crevices in the rock. Mr. Chapman dug burrows into the side of a hill. The experiment failed. He tried building houses of cement. The cement house was too damp. He built houses of adobe brick and they were not satisfactory. He built houses of telephone conduit tile and found they had certain shortcomings. Over a period of several years and at an expense of many hundreds of dollars, he experimented with 12 different types of housing.

Finally he decided in favor of houses of kiln-dried lumber and pens of hardware cloth and wooden framework.

From the original 11 the herd has increased to about 900.

There are also a number of other chinchilla farms in various parts of the United States—in Idaho, Wyoming, Utah, Pennsylvania, Wisconsin and New York, all of them established from breeding stock from the Chapman farm. There are four such farms in Utah. One of the most successful has been that of Mrs. R. E. Hughes, of Idaho Falls, Idaho. She began several years ago with a pair of Chapman chinchillas. Now she has 60, valued at approximately $100,000! Two other successful breeders are M. E. Barrus, of Afton, Wyoming, and Professor Henry Petersen, of Cache Valley, Utah.

Many things about the habits of the chinchillas are still not definitely known and probably cannot be determined for at least another 20 or 30 years. However, most of the major problems have been solved for all practical purposes of pelt production although that is still years in the future.

There are only about 25 full-length chinchilla coats in the world today. Most of these are

reconditioned pelts in the hands of royalty and millionaires, yet they are valued at approximately $80,000 per garment. While a single, new chinchilla pelt is now worth from $85 to $250, depending upon the quality, the Chapman farm has not yet killed an animal for its pelt. Its commercial foundation is rooted in the sale of breeding stock. If you'd like to buy a few chinchillas and go into the business, the Chapman farm will sell you pedigreed pairs, developed by selective breeding, approximately 15 generations removed from the parent wild stock—for $3,200 a pair. That is not merely the price they ask; it's the price they get for every available pair!

With each pair goes detailed information gathered by two generations of the Chapman family through soul-trying experimentation at an expense of thousands of dollars. But that isn't all. They'll stand back of your purchase with all sorts of personal service—even to sending their own private chinchilla doctor from California to any point in the continental United States if your chinchillas get sick and such service seems necessary.

The average life span of the chinchilla has yet to be determined, but there is every indication that it is probably 35 to 40 years. The period of young bearing fertility is likewise unknown, but it is apparently 20 to 25 years. This seems to be indicated by the fact that one female in the Chapman herd is now the mother of 18 litters, while an old "buck" chinchilla, known to be 20 years old, is still rendering stud service.

The average litter of a female chinchilla is two—any number from one to four. In their native habitats chinchillas breed only once each year, but in the mild climate of Southern California, the Chapman animals bear twice and sometimes three times a year.

This increase in the birth rate by acclimatization in a mild climate is one of the reasons for having located the farm near Los Angeles.

A Chinchilla reaches adult life in approximately 18 months. The fur of an animal raised in the coastal lowlands of California is not as heavy or as valuable as the fur of one raised in a colder climate, but that is of scant importance at present. Meanwhile, the Chapman experimental farm in Big Bear Valley, high up in the San Bernardino Mountains, where near-zero winter temperatures prevail, has proved that putting a heavy coat on a chinchilla raised in the warm lowlands, involves nothing more complicated than moving the animal to a cold climate for several months.

From these observations R. E. Chapman visualizes the day when fur farms will speed production by centering their breeding activities in Florida, Southern California and the Gulf states, operating in conjunction with "pelting farms" in Maine, Montana, perhaps Alaska.

Chinchillas are monogamists and a pair once mated remain mated for life. As they are nocturnal creatures, the babies are born with their eyes open. They are exceptionally large at birth, compared with the size of the adults. An average adult will weigh about 20 ounces. The newborn young are two to three inches in length and will weigh, perhaps, one or 1½ ounces each.

There is almost no period of helpless infancy. The babies are up and scampering around soon after they draw their first breath.

The chinchilla is an exceptionally clean animal, odorless and immune from vermin.

At the Chapman farm, everything moves with the efficiency and precision of a medical research laboratory. On a tract of two to three acres, behind tall, woven-wire fences, are 24 structural units divided into 541 chinchilla pens. Cement sidewalks lead to the door of each pen, and no one, employee or visitor, is permitted to enter a pen without disinfecting his shoes in a special chemical box in front of each door. All work such as pen cleaning, feeding, inspection, is carried out on prescribed schedules.

Food is carefully weighed or measured. Whole corn, chopped alfalfa and rolled oats are now the staple diet, with supplementary feedings of fresh vegetables, raisins, nuts, orange juice, and cod liver oil.

Each animal is also provided with a block of wood which seems to satisfy the rodent fondness for gnawing things.

If a chinchilla gets sick, he is taken immediately to the farm's isolation hospital. An animal in need of surgical attention receives it promptly. An associate of the Chapman farm staff is Dr. Hylan Keagy who, by several years of intensive study and practice, has become the only veterinarian on earth qualified to call himself "a chinchilla specialist."

Thus far no serious chinchilla diseases have appeared. Sporadic surgical cases are usually of an obstetrical nature or the result of injuries. Some minor dental attention has occasionally been found necessary for the chinchilla that breaks a tooth or whose gnawing incisors have grown too fast for the easy domestic life to wear them down.

Many of the chinchillas are as playful as kittens and as docile as pet rabbits.

Although they would be capable of inflicting a serious bite, they will submit to being petted and handled by strangers.

In spite of this docility, chinchillas are natural snake killers. This was noted some years ago by the late Mr. Chapman during the life of the experimental camp in the Tehachapi Mountains. Numerous rattlesnakes seemed to be attracted to the camp with the mistaken idea that the chinchillas were rabbits or other small rodents. Every snake ever known to visit the camp was found next morning, dead from a single thrust of a chinchilla's gnawing incisors through the vertebra and spinal cord just behind the head.

There are no rattlesnakes near Inglewood, but the coastal lowlands are well populated with the large, harmless, California gopher snakes. A big gopher snake would undoubtedly consider an adult chinchilla a tempting meal. But it's always a bad night for any snake that gets such an idea.

The future of the Chapman enterprise appears to be certain. It will be years before there are enough pelts to make full-length coats.

For many a year to come there lies but a single accomplishment between the chinchilla breeder and enormous profits. That accomplishment is the raising of chinchillas.

Animals raised in captivity by selective breeding produce a better pelt even in the balmy climate of Southern California than anything that ever came off of a wild chinchilla. Those raised in Idaho show winter coats of a quality such as the fur trade has never known. The domestic production of such winter pelts coupled with further improvements now known to be attainable, therefore, promises to produce a chinchilla fur more beautiful, more popular, and at lower prices.

Breeding Programs Through Bull Associations

Condensed from Guernsey Breeders' Journal

R. G. Connolly

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ORGANIZING dairy cattle breeding is understood to mean the systematic mating of dairy cattle according to a definite longtime plan that will enable one to identify, trace, and analyze various genetic characters evident in populations of related dairy cattle. Any dairy cattle breeding program that permits the cumulative assembling of genetic data pertaining to cattle related by descent may be regarded from the genetic standpoint as an organized dairy cattle breeding program.

Major emphasis has been placed upon the herd sire in most organized breeding programs, and concurrently the measurement of genetic performance has been largely in terms of the production records of the daughters. Most sires being proved at present are owned by individuals. If these proved sires are the important avenue of approach in breeding up better strains of cattle, then some attention must be given to the perpetuation of the service and the blood of proved sires in enough cattle over a sufficient number of generations to permit the proper analysis and evaluation of the genetic traits existing in the family strains. The magnitude of such an undertaking bespeaks the need for cooperative breeding methods.

In the last analysis bull proving and the search for brood cow families should serve as important steps to a more comprehensive breeding program involving many more cattle than are now under observation. There should not only be a program of discovery such as our proved sire and brood cow investigations seem to be; but there should also be promulgated breeding programs by which superior inheritance discovered in individuals might be purified and concentrated in many cattle through intelligent matings. How such a program of genetic utilization can be developed among practical dairyman who are only now learning of the economic possibilities of dairy

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cattle breeding is a complex problem not yet solved.

The long time required to assemble dependable genetic information for a breeding program; the economic risk involved in dairy cattle breeding; the whimsical instability of men's reactions to the revelations of nature; and the lack of sufficient facts as well as standard fact finding methods are impediments in any comprehensive dairy cattle breeding program. Individually, dairymen strive to learn the genetic constitution of their cattle, but the earliest success and most lasting benefits are likely to be reserved for those men who breed large numbers of cattle and are able to perpetuate the lives of bulls and cows until their genetic influences can be analyzed and evaluated. This suggests the need for co-operative action among dairymen.

Co-operative bull associations, if properly organized, are replete with possibilities for individual dairymen who are not situated to keep more than one bull or who lack facilities for following the several methods of breeding—inbreeding, line breeding, multiple breeding to proved sires, etc. —to verify the purity of the inheritance of certain desirable characters and to perpetuate those characters in future generations. Where bulls are owned jointly, and the dairymen are of kindred minds and interests, bulls may be exchanged and proved with a minimum of risk to the individual dairyman. More comprehensive proof can be obtained on a bull if he is used in several co-operating herds and also when meritoriously proved bulls are discovered, they can be rotated among the several co-operating herds to recoup losses that will result when unsatisfactory bulls are proved. Furthermore, the female lines of related cattle can be studied to better advantage, and the heritable traits that determine productive ability, body conformation, and other physical characters can be concentrated in a large number of cattle in the least possible time if several dairymen are united under a co-operative breeding program.

Dairy cattle breeding programs conducted through co-operative bull associations lend themselves to better supervision from the state extension dairy husbandman and more nearly justify the talent and time required in the administration of a long-time dairy breeding project in the extension program. Finally, the possibilities of success when breeding up dairy cattle are likely to be greater if dairymen will merge their cattle breeding interests into a single program and develop the program as a co-operative dairy bull association. The benefits that

may be expected from the co-operative treatment of so large a venture as progressive longtime dairy cattle breeding societies is demonstrated by the signal accomplishments of co-operative breeding societies in Denmark, Holland and other countries.

Strawberry Practices in the South

Condensed from Better Crops With Plant Food

L. A. Niven

THE average acreage in the United States devoted to the commercial production of strawberries is 180,360. Of this acreage 96,470 or 53.5 per cent is located in the 13 Southern states.

While the yield in the South, as elsewhere, varies from year to year, the average is around 1,500 quarts per acre, or approximately 145,000,000 quarts. If we assume the price average to be 10 cents per quart, which isn't far out of line over a period of time, we see this crop represents $14,500,000 annually to Southern growers.

Beginning in mid-winter in Florida, the season gradually pushes North, the shipping being largely completed in the upper South during May.

The strawberry may be set any month during the year, but the best time is in fall, winter, or early spring. In the middle and upper South most of them are usually set between October and early April. Fall setting enables the plants to become established, for the root system to start growth, thus putting the plants in a more vigorous condition when the real growing season is at hand. Then, too, when set in fall they will bear a small crop the following spring, whereas those set in late winter or early spring will not bear until a year after being set.

The strawberry will grow well on almost any type of soil, provided it is well drained and fertile. However, it is highly desirable that they follow a cleanly cultivated crop, such as cotton, corn, tobacco, soybeans, etc. In preparation for setting the plants the ground should be broken deep and thoroughly pulverized by harrowing. When the ground is thoroughly prepared, lay off the rows three and a half to four feet wide with a rather deep fur-

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row or trench. Put in the bottom of this furrow a good commercial fertilizer, such as a 6-8-6 or 6-8-8, at the rate of 500 to 1,000 pounds per acre, or two to four pounds for each 100 feet of row space. Then throw the dirt back on it with two furrows so as to form a slight bed, and the plants are ready to be set. Be sure to get the fertilizer deep enough in the ground so that when the strawberry plants are set the roots will be at least an inch or two above the fertilizer, because allowing the roots to come in contact with the fertilizer will result in injury to the plants.

The plants should be set from 24 to 30 inches apart in the row. In the home garden set 18 to 24 inches apart. Plants set during late winter or early spring will, if allowed to do so, produce a few berries that season, but in order to get the best and most vigorous plants for producing a heavy crop the following season, it is advisable to pinch off the few blooms that appear the first season.

Cultivate often enough throughout spring, summer, and into the fall to keep them free of all weeds and grass. Do not disturb the runners as they develop. Allow them to run over the row and take root wherever they will, thus forming new plants to produce a heavy crop next season. Where one has set plants very close together and has only a small piece of ground, these runners may be set off, leaving only the parent plant and a few plants close around it to produce berries, but this method is not generally practiced except in Florida and in the small home garden where space is quite limited.

Mulching with pine straw, wheat straw, or other similar material is practiced by nearly all good growers. It is usually applied in January or early February, and at the rate of a ton or more per acre. This is done to hold the berries up off the ground and prevent them from being ruined by grit.

In late August or early September give an application of commercial fertilizer. Scatter it broadcast on top of the plants, covering the whole row and middle with it, and follow immediately with a broom or brush, sweeping the fertilizer off the leaves of the plants so as to get it down on the ground and prevent burning of the leaves. Apply when leaves are dry. Use 500 to 1,000 pounds per acre, or two to four pounds for each 100 feet of row space. Give another application of the same kind and amount of fertiilzer in the same way in late fall, because it is during this time of year that the buds are forming which will produce berries the following season.

In the past the most largely

planted variety in this section has been the Klondyke. This is largely because it is a berry that is quite firm and ships well. It is not, however, the best variety as far as quality is concerned and is being replaced by the Blakemore and Aroma. Other good varieties are the Premier, Missionary, New Southland, Dorset, Fairfax, Progressive Everbearing, and Gandy.

As soon as the crop of berries is off, work out the old plants and grow new ones for the coming crop. This method, of course, does not apply to the Gulf Coast section where new plants are usually set each year. There are two common methods of doing this, the most common of which is to bar off on both sides of the row, leaving a strip about a foot wide. Then with another turning plow furrow cut off about half of this strip, which turns under the old mother plants and moves the top of the new row over a few inches from where it was before.

In this turn plow furrow put 500 to 1,000 pounds 6-8-6 or 4-8-6 or 6-8-8 fertilizer. Then run a drag harrow straight across the rows several times to kill grass. This covers the fertilizer and finishes destroying the plowed up plants. This leaves a strip of plants three to six inches wide, and the field looks as if it had been wrecked, but it hasn't. If the plants left are not as vigorous looking as they should be give a top-dressing of 100 to 500 pounds nitrate of soda at this time. Put it on top of the plants when they are dry. From now on cultivate just as the first year the plants were set, as you are actually growing new plants just as when first started.

The other method of growing a new crop of plants is very similar to the one just outlined. It consists of first running a bull tongue furrow on top of the row and under old plants, rooting them out. Then run a turning plow furrow 4 to 6 inches to one side of the row, forming a balk. From this time on work as by the other method.

It is usually not desirable to grow new plants from the old ones more than two years, and many good growers say not more than one.

New Uses for Fruits and Vegetables

Condensed from Farm Research

Donald K. Tressler

ALTHO the drum drying of milk and certain other products has been employed for many years, it has been only recently used for the dehydration of fruits and vegetables. The principle is simple enough; involving the spreading of a thin film of the product to be dried on the exterior of a horizontal steam-heated drum which is revolving slowly enough so that the material is dried and scraped off before a complete revolution has been made. Apple sauce can be dried in 20 seconds in this way, provided dry air is blown over the drum during its operation. The dehydrated product is scraped off the drum by a horizontal knife, cracked into fine flakes and sold as apple film or flakes. It keeps well provided it is held in a moisture-vapor-proof package. It has many more uses than ordinary evaporated apples, for example, in confectionery and flavoring. During the present season in one plant near Geneva more than 600 bushels of apples have been dehydrated daily by this process in a room about 20 feet long and 15 feet wide.

Many other products are being dehydrated by this process, cranberries, bananas, tomatoes, onions, and pectin, and, as yet, its commercial development has only begun.

The rise of the American fruit juice industry has been little short of phenomenal. Up until a few years ago about the only unfermented fruit and vegetable juices of commercial importance were apple juice or cider, orange juice, and grape juice. Moreover, grape juice was the only one of the three that could be preserved satisfactorily. At present, tomato, pineapple, and grapefruit juices have become very popular and are now preserved in large quantities. Cherry, cranberry, prune, apricot, sauerkraut, and certain tropical fruit juices have been introduced and promise to become of commercial importance. Methods of preserving the juice of rhubarb, passion fruit, and certain other fruits and vegetables have been perfected so that the commercial production of still more juices is a commercial possibility.

According to the Western Canner and Packer, the pack of

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fruit and tomato juice in 1935 amounted to a total of approximately 18 million cases. In 1936 about 22 million cases of fruit and vegetables juices were packed, and 500,000 tons of fruit used for preserved juice. Since the production is still increasing at a rapid rate, one can only guess how high it will go.

Altho apple cider stands fourth on the list of juices preserved by canning or bottling, yet since a very great quantity is consumed without preservation, it is probable that more of this juice is made than any other. It is unfortunate that so little care is given its preparation and preservation that most of it sells at 20 or 25 cents per gallon if indeed the farmer is able to get that much for his product. It is also extremely unfortunate that no method of preservation, except freezing, has been found which does not impair the flavor of the product.

Clarification is necessary before cider can be pasteurized or carbonated, and this removes much of the "body" and some of the flavoring components. Once the cider has been clarified it can be preserved either by pasteurization or by Seitz filtration.

Clarified cider may also be carbonated, and if the product is Seitz filtered and bottled aseptically, needs no further preservative treatment. Or if it is lightly carbonated, it may be bottled and pasteurized without marked change. Carbonated cider can be prepared so cheaply that it should be offered in competition with 5 cent "pops." It is an inviting beverage and should have a future.

Freezing is the ideal method of preserving cider and all other fruit juices, except grape juice; for freezing does not cause any noticeable change in flavor, body, or appearance. Moreover, no special equipment or method is necessary to preserve cider by this method. It may be packed and frozen in glass bottles or carboys or in tin or paraffined paper containers with no danger of breakage, provided the containers are not filled more than nine-tenths full.

Cherry juice has been introduced recently and is becoming very popular. It is easy to preserve and may be clarified and pasteurized without loss or change of flavor. It may also be preserved by freezing. The best juice is made from Montmorency cherries and there is often a glut in the market for this variety. Carbonated cherry juice is an excellent product.

Rhubarb is a vegetable, but its juice resembles in flavor the fruit juices rather than other vegetable juices. Recent work in the Station chemical laboratory has shown that rhubarb juice

possesses considerable possibilities. The crushed or shredded stalks yield a high percentage of juice of pleasing flavor. It is too sour for normal palates, being rather high in acid and very low in sugar. Moreover, it contains much oxalic acid which must be removed before the juice is suitable for use.

For these reasons the juice should be clarified by treatment with the pectic enzyme, pectinol, and then treated with calcium carbonate to precipitate the oxalic acid. After filtration the juice is diluted with either plain sweetened water or sweetened carbonated water to reduce its acidity to about 0.7 per cent and to bring its sugar content up to about 14 per cent.

Rhubarb juice blends well with most fruit juices and especially well with those low in acid. A grape-rhubarb juice blend is somewhat more pleasing than straight Concord grape juice and can be prepared at much less cost. When diluted with carbonated water this beverage is especially attractive.

The concentration of fruit juices is becoming an important industry. The most common method is simple evaporation in vacuo. The better types of equipment employ some method of recovering the fruit juice esters which are ordinarily lost in the vacuum evaporator. Another method which is sometimes used is slush freezing followed by centrifuging of the slush. The ice which remains in the centrifuge contains little but water, and the mother liquor contains practically all of the flavoring components. Concentrates made by freezing undergo less change than those produced by vacuum evaporation.

The principle use of fruit juice concentrates is as soda fountain syrups and for the preparation of various types of soft beverages. Some is diluted and fermented for the production of wine.

Apple concentrate has been suggested as a syrup for use on pancakes. Most New York State apples yield a syrup too sour for this purpose. If a portion of the acid is neutralized the product may be an entirely satisfactory table syrup.

The Chemistry Division has been studying for several years the properties of pectin obtained from apple pomace. Last season we studied the quality of pectin obtained from apple thinnings and have found that this product may be used in making high grade jelly. We have also worked out simple methods of making good pectin from apple thinnings which may be used by the farmer himself.

Live Stock Farming in England

Condensed from The Rural New-Yorker

Charles E. Eshbach

WHEN the Pilgrims settled in Plymouth they introduced into New England the form of agriculture typical in England. But in the planting of their first hills of corn there were merged two different forces in the centuries-old development of agriculture—the relatively advanced intensive farming methods of the 17th century British farmer and the crude cultural methods of the American Indian. It was upon this basis that New England's diversified farming had foundation. And today the agriculture of Old England differs in many respects from the agriculture of America.

The World War had revolutionary effects upon systems of farming in England. In pre-war times, with the exception of mountain sheep farming, practically the whole of the rural part of the country was divided into small farms, varying in size from 100 to 500 acres with a mixed or general system of management, a nucleus of six to ten farms being held in tenure by farmers under one landlord, frequently a titled person, the entire area being referred to as his estate.

Economic depression, high taxes on these estates, and other contributing causes resulted in such an acute state of financial embarrassment that many of these large estates have been broken up and offered for sale at relatively low prices, to be purchased by the tenant farmers.

The Agricultural Holdings Act of 1923 has been an incentive to higher farming with its compensation to the outgoing tenant by the landlord for unexhausted improvements, drainage, residual manurial values and general increase in the value of the holdings effected by the tenant. On the other hand, a landlord by this legislation is protected from the type of tenant who occupies the farm for a short period and takes the fertility out of the soil without replacing it by applying manure. Such a tenant places himself open to claims by the landlord for dilapidations and diminished value.

Improved credit facilities for both short term and long term loans to enable farmers to carry

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out radical land improvements such as drainage, land reclamation, warping, marling, and the erection of modern permanent buildings has had an effect in stabilizing the industry and increasing the output of the land.

There are four forms of land tenure at present existing in England. The first and most common is known as "Tenancy for Years." Under this system a tenant rents a farm for a long period, either 5, 10, 15, 20, or perhaps even 50 years. This safeguards the tenant against yearly notice and consequent loss by having to move, enables him to farm on a long-term program, and does not limit his system as does the second form of tenure known as "Tenancy from Year to Year" under which a year's notice to quit by either party is sufficient.

To a much less extent "Tenancy at Will" is a form of tenure where the tenant or landlord can give notice to quit at almost a moment's notice and there is no power for the tenant to sublet even though not prevented by the terms of his lease. The last form of tenure is that known as "Tenancy at Sufferance" where an aged tenant, who has rented the farm throughout his life, is allowed in his later years to remain on the farm free of rent. He, of course, is not allowed to sublet and is only resident at the pleasure of the landlord.

Many farms have been rented by the same family for periods of four and five hundred years and there are many cases where, in times of depression, the tenant was unable to pay his rent, the landlord forgot about such a detail and allowed the farmer to carry on rent free for a year or two until his position improved, rather than risk leasing the farm to a bad tenant.

England is divided into three agricultural regions—an eastern, a central and a western region. On the east side of England with a relatively low rainfall and pasture of a dry type and more herbage, bullock fattening and wheat growing predominate and soil fertility is maintained by farm-yard manure, although on the lighter soils of east Anglia which do not hold grass well and where beef fattening under stall conditions is an uneconomic proposition, mechanization has been adopted where the farms are large enough and fertility has been maintained by green manuring.

On the eastern side of the country, the Lothian district of Scotland, which is referred to sometimes as the garden of the British Islands, is noted for the quality of the beef produced. The soil is of the old red sandstone formation and yields some of the

best potatoes grown in the British Isles. The predominant beef breed in this district is the Aberdeen-Angus and the steers are fattened over Winter in covered yards on hay, swedes, turnips and cut straw, with a little oil cake, chiefly linseed cake, to finish them. The dung produced is chiefly applied prior to the root crop in the rotation. Wheat and barley are the chief crops grown in this area. To a lesser extent oats is an important crop.

The second region is the midlands which is largely industrial and farming is adapted to meet the requirements of largely populated towns with potatoes, milk, and green vegetables the chief crops. Soil acidity is a real problem on many of the farms situated near to the industrial centers due to acid fumes and frequently obviates dairying due to the low-quality of the pastures in conditions where the clovers and bottom grasses die out. The growing of the sugar beet, which would be a solution to many of these farmers, cannot be carried on in many instances for the same reason. Quite different conditions exist on the west of the country, the rainfall being much larger and the distribution better. The pastures, in consequence, are much more luscious and dairying predominates. Swedes and turnips are the chief root crops. Marrow stem and thousand-headed kale also are grown extensively. The hay is very good in quality and quantity and the chief crop is oats. The oat straw produced has a very high feeding value and supplements hay and roots in the winter ration for dairy cows.

In the more elevated districts on poorer farms with not so good pastures, rearing of dairy cattle is practiced and these animals are sold young before the third calf to wholesale milk producers. The skim-milk is used to rear the calves and the cream for butter-making. Under better conditions as in Cheshire, Somerset and Dorset, on farms typically dairying in character but located in areas remote from a market, cheese-making is the method of utilizing the milk produced, it being marketed at some convenient time.

The most popular breed is the Ayrshire, followed by the Dairy Shorthorn, British Friesian (Holstein), Jersey, Guernsey and Kerry. The reason for this popularity of the Ayrshire is due to the fact that many more tuberculin tested herds exist in the Ayrshire than in any other breed. Many farmers producing tuberculin tested milk are doing so on farms where the rent is so high that breeding and rearing herd replacements is prohibitive. They must go to reservoir farms for

fresh stock and Ayrshire tuberculin tested cattle are readily available.

With regard to tuberculosis, infection has been so high in cattle throughout the country that a long term policy of gradual eradication had to be adopted. The work of eradication is progressing rapidly now and tuberculin tested herds are the rule rather than the exception. In a like manner, abortion, mastitis, and Johne's disease are being eradicated.

The striking difference in American dairy cattle is the fact that in conformation animals of the same breed are much larger than in England. Bone development is finer and the animals do not carry so much flesh in England. Mature Ayrshires will scale 900, Jerseys 750, Shorthorns 1,000 to 1,100, and Friesians 1,100. In some respects, English farmers have carried this fineness too far and it has led to constitutional weaknesses. In many cases breeders have sacrificed vigor for a higher yield fetish.

The average yield for all dairy cows at all ages throughout the country for 46-week lactation would be about 6,000 pounds. Individually, certain Friesians at third and fourth calves have yielded 30,000 pounds. There has been no incentive in the past to breed for particularly high butter-fat content as a minimum of 3 per cent is all that the law requires. So the tendency has been to produce as much milk as possible and just keep within the legal requirements.

The sheep industry is divided into three types. The first type is hill sheep farming at high altitudes and exists in the highlands of Scotland, Cumberland and Westmoreland, and the Welsh mountains. The farms are large, 1,000 to 3,000 acres and are let at about 50 cents or two shillings per acre, carrying one to three ewes to the acre. Of late, mineral deficiency and disease problems have affected those farms badly and the profits are very low. This type of sheep farming is very specialized and a hill sheep farmer is born to the game rather than taught it. Scotch Blackface, Cheviots, Hardwicks, Welsh and Swaledale are the common breeds and the ewes lamb in the open being brought down by the shepherd to lower parts of the hill. A shepherd will look after 400 ewes with help at lambing time. The shepherds receive about $10 a week and perquisites. They are extremely autocratic and even the employer himself does not dare to dispute a shepherd's judgment. They live entirely for their sheep and sheep dogs, and seldom leave the farm.

The second type of sheep farming is known as the flying

flock system and is common as a sideline to general farms. The half-bred ewe or Border Leicester and Cheviot is the most popular. Crop ewes are purchased in September. A down ram is used on these ewes, Oxford and Suffolk down being most popular. Lambing takes place from January onwards and the ewes and lambs are sold off about June, so that the farm is free of sheep before the grass is burned up or parasites become a nuisance.

The last main type of sheep farming is the fattening down-breed on root crops. The sheep are folded on swedes and turnips and kale. They clear off the crop, replace soil fertility, and as this system is practiced on lighter soils the sheep improve the physical nature of the land.

Specialized poultry farms are a post-war development and big strides have been made in recent years. The largest numbers of home-produced eggs still come from general farms. But, gradually, poultry specialists are increasing in numbers.

The most popular breeds are the R. I. Red, White Wyandotte, Black and White Leghorn and, for table purposes, the Light Sussex. The British public demands a white-skinned bird and these frequently bring six to eight cents per pound more than the yellow-skinned varieties. Brown eggs, too, are at a premium. Perhaps, the most striking development has been the recent tendency to specialization within the industry itself, so that at present many farms do nothing else but produce hatching eggs which are purchased by commercial hatcheries. The chicks are sold to rearing farms. Then the cockerels are sold to fattening farms at about 14 weeks to be finished for market, and the pullets are sold at three to four months to commercial egg farms.

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